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ABSTRACT

A total of 441 articles related to the semantic and acoustic properties of memory are cross-referenced and listed alphabetically with the authors' original abstract or summary. (Author)

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SEMANTIC AND ACOUSTIC PROPERTIES OF MEMORY: AN ANNOTATED, CROSS-REFERENCED BIBLIOGRAPHY

Steven L. Hackbarth

ABSTRACT

A total of 441 articles related to the semantic and acoustic properties of memory were cross-referenced and listed alphabetically with the authors' original abstract or summary.

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SEMANTIC AND ACOUSTIC PROPERTIES OF MEMORY: AN ANNOTATED, CROSS-REFERENCED BIBLIOGRAPHY

Steven L. Hackbarth

Properties of verbal memory are inferred from learning and retention performance in relation to the dimension along which test materials are selected. The semantic and acoustic properties of memory have been investigated primarily by employing letters and words which are similar in meaning or sound in a variety of storage and retrieval tasks. Some studies attempt to determine the magnitude of facilitation or interference in long- or short-term memory in relation to the degree of similarity. Others are designed to delineate the conditions under which subjects are capable of or tend to employ dimensional similarity as an encoding or retrieval strategy. The present report comprises an attempt to list all such empirical studies as well as directly relevant review and theoretical papers.

In order to insure a complete listing of recent and relevant articles, Psychological Abstracts (Volumes 39-43 inclusive) were consulted as well as the 1969 and early 1970 issues of Acta Psychologica, American Journal of Psychology, British Journal of Psychology, Canadian Journal of Psychology, Child Development, Cognitive Psychology, Journal of Educational Psychology, Journal of Experimental Child Psychology, Journal of Experimental Psychology, Journal of Psychology, Journal of Verbal Learning and Verbal Behavior, Perception and Psychophysics, Perceptual and Motor Skills, Psychological Bulletin, Psychological Record, Psychological Reports, Psychological Review, Psychonomic Science, Quarterly Journal of Experimental Psychology, and Reading Research Quarterly. Comprehensive coverage of earlier research was facilitated by reference to bibliographies of the more recent articles.

Each article selected for inclusion on the basis of relevance to the investigation of the semantic and acoustic properties of memory was classified according to: 1) the general experimental design (paradigm) employed (or if it was a review or theoretical paper); 2) the age of the subjects; 3) the test material used, stimuli and responses; 4) the relationship between the stimuli and responses, semantic or acoustic; 5) the type of learning task required of each subject; 6) the interval of time delay between end of learning and beginning of recall; 7) the type of recall task required of each subject. All of the articles were then typed in bibliographic form including abstract or summary as prescribed in the Publication Manual of the American Psychological Association, 1967 revision.

In order to facilitate cross-referncing, articles were numbered consecutively in alphabetic order. The number of each article is listed under the appropriate heading for each of the seven major variables:

I. Paradigm

A. Acquisition and retention: includes the paired-associate, serial and free learning and retention paradigms most commonly employed in investigating the effects of dimensional similarity on trials to criterion in learning and/or amount or latency of recall.

B. Intrusions: subjects are required to either listen to or read a list of words and are then immediately required to recall as many as they can. Analyses are made on the number of responses recalled which were not given on the original list (intrusions), however are acoustically or semantically related to the original list stimuli.

C. False recognition: subjects are required to either listen to or read a list of letters or words. In some of the studies subjects are required to indicate whether or not they think each successive word was given earlier on the list by saying "yes" or "no." In other studies the complete list is presented prior to a recognition task in which there are items semantically or acoustically related to the original list stimuli and the subject must indicate which alternatives he feels were on the original list. Analyses are made on the number of times each subject indicated that he recognized a particular letter or word when, in fact it was not previously given.

D. Clustering, ordering, and organization: subjects are required to either listen to or read a list of words and are then asked to recall them in any order. Analyses are made on the number of semantically or acoustically related original list stimuli reported in succession.

E. Transfer: subjects are required to learn two different lists of words with different groups receiving lists of varying interlist semantic or acoustic similarity. Learning performance on the second list or recall performance on the first list after learning the second is measured and comparisons are made between groups which received different degrees of interlist similarity.

F. Word association: subjects are required to respond with whatever word they could think of when presented a word aurally or visually. Note is taken of the type of relationship between each stimulus word and the subject's response to that word.

G. Semantic generalization: an instrumental conditioning paradigm is used in order to train subjects to make an observable response to a given stimulus word and subjects are then tested for generalization by noting the tendency for the response to be elicited by a second semantically related stimulus word.

H. Verbal discrimination: includes those studies in which subjects are presented with a list of word pairs in succession which are semantically or associatively related and are informed which one of the two is "correct." Subjects are then given each of the pairs again and must indicate which of the pair was originally designated as "correct." Note is taken of the degree to which relatedness interferes with discrimination.

I. Bilingual: bilingual subjects are presented either a list of words or connected discourse which includes words in two different languages. Semantic facilitation or interference is inferred from the effect of having the same word presented in both languages on recall or learning performance.

J. Theoretical and review: articles which review directly relevant experimental articles or discuss and attempt to explain the experimental findings however are not a report of the results of primarily one experiment or series of experiments.

II. Subjects

A. Children: nursery school to eighth grade.

B. High school: grades nine through twelve.

C. College and adult: college students, housewives, and military personnel.

III. Test Material

A. Letters

B. Trigrams and other nonwords

C. Words

D. Sentences and connected discourse

IV. Test Material Relationship

A. Formal and acoustic similarity: letters and/or phonemes in common between test items.

B. Semantic, associative, and categorical similarity: meaning and/or association (as measured by norms) and/or class membership in common between test items.

V. Learning Task

A. Free: subjects receive one complete presentation of a list of letters or words, a sentence or connected discourse without interruption for recall.

B. Paired associate: subjects are presented with a list of paired letters or words, one at a time. After the first presentation, only one member of the pair is presented (stimulus) and the subjects are required to respond with the other member of the pair (response). Each stimulus may be shown in isolation followed immediately by presentation of the pair or learning and recall trials may be separated by presenting all of the pairs successively (study trial) followed by presentation of all of the stimuli in a different random order to prevent serial learning. The list may be presented for a fixed number of trials or until each subject attains a criterion level of performance.

C. Serial: subjects are repeatedly presented the same list of letters or words successively and in the same serial order. Following exposure of each word, the subject must anticipate and verbally respond with the next word in the series prior to its exposure. The list may be presented for a fixed number of trials or until each subject attains a criterion level of performance.

D. STM (Peterson): subjects receive one complete presentation of a small number of letters or words (presumed not to overload the short term storage capacity of immediate memory), and must then perform some interpolated activity designed to prevent subvocal rehearsal (usually counting backwards by three's) prior to recall.

E. Continuous presentation: subjects receive one complete presentation of a large number of letters or words and are required to indicate whether or not each successive letter or word had previously been presented.

VI. Retention Interval

A. Immediate recall (only when the amount to be recalled is within the immediate memory span): maximum number of items to be recalled less than ten and recall immediately follows learning task or interpolated activity not exceeding 30 seconds.

B. Delay less than one hour: includes immediate recall when it is presumed that number of items to be recalled has exceeded the limited capacity short-term memory store as well as all studies in which the delay interval between learning task and retention is less than one hour.

C. Delay over one hour.

VII. Response Variables

A. Free recall: items may be recalled in any order usually without time restriction.

B. Ordered recall: items must be recalled in the serial order in which they were presented usually without time restriction.

C. Cued or paced recall: stimuli are presented to which subjects must respond with the appropriate response. Stimulus presentation may be paced or subject may be given ample time to respond to each stimulus.

D. Recognition: subject must indicate which response is the correct or previously given one from one or more given alternatives.

E. Nonverbal: motor or galvanic skin response.

Semantic and Acoustic Properties of Memory: An Annotated, Cross-Referenced Bibliography

I. Paradigm

A. Acquisition and retention

1, 3, 4, 5, 7, 8, 13, 14, 15, 16, 17, 18, 21, 22, 23, 24, 26, 27, 36, 37, 38, 43, 47, 48, 49, 50, 52, 53, 54, 60, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 79, 81, 83, 89, 90, 91, 92, 93, 102, 105, 108, 110, 112, 114, 115, 117, 121, 128, 129, 131, 137, 139, 140, 142, 143. 144, 145, 147, 151, 152, 153, 154, 155, 156, 157, 161, 165, 170, 172, 173, 175, 176, 177, 178, 182, 183, 184, 185, 186. 191, 192, 194, 195, 196, 197, 198, 203, 205, 209, 210, 211, 213, 214, 215, 222, 224, 226, 228, 232, 233, 234, 235, 236, 237, 238, 239, 244, 245, 246, 247, 248, 253, 254, 255, 256, 257, 265, 267, 269, 270, 271, 272, 273, 274, 277, 278, 279, 281, 282, 283, 284, 285, 290, 292, 297, 298, 299, 301, 308, 309, 310, 312, 314, 315, 317, 318, 319, 320, 322, 323, 324, 328, 329, 330, 332, 333, 334, 335, 338, 339, 342, 343, 344, 345, 346, 347, 349, 350, 352, 353, 354, 356, 357, 361, 363, 365, 367, 368, 370, 374, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 390, 393, 394, 395, 396, 397, 398, 399, 400, 401, 406, 409, 411, 412, 413, 414, 415, 416, 417, 418, 425, 426, 427, 432, 433, 434, 435, 436, 437, 438.

B. Intrusions

82, 109, 171, 174, 227.

C. False recognition

9, 10, 11, 106, 118, 130, 162, 166, 167, 168, 169, 200, 208, 391, 403, 404.

D. Clustering, ordering, and organization

2, 6, 28, 29, 30, 31, 33, 34, 51, 55, 57, 58, 59, 61, 62, 80, 101, 104, 113, 123, 125, 126, 138, 149, 150, 181, 187, 188, 189, 190, 193, 230, 249, 250, 251, 258, 275, 304, 305, 306, 313, 316, 327, 331, 351, 378, 405, 428.

E. Transfer

20, 25, 40, 42, 44, 85, 96, 97, 98, 99, 100, 124, 135, 159, 179, 180, 201, 204, 259, 264, 289, 293, 295, 302, 311, 325, 336, 337, 340, 341, 348, 355, 369, 371, 377, 419, 420, 431, 439, 441.

F. Word association

47, 78, 84, 107, 133, 136, 146, 148, 296, 430.

G. Semantic generalization

32, 86, 87, 111, 134, 219, 221, 231, 241, 242, 243, 263, 303, 307.

H. Verbal discrimination

19, 22, 46, 63, 88, 95, 116, 119, 120, 122, 141, 160, 199, 204, 206, 389, 440.

I. Bilingual

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J. Theoretical and review

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II. Subjects

A. Children

5, 7, 9, 19, 28, 47, 51, 114, 115, 116, 121, 142, 143, 144, 166, 167, 169, 170, 174, 183, 229, 259, 290, 294, 296, 303, 317, 318, 327, 347, 348, 349, 350, 354, 363, 367, 380, 428, 432.

B. High school

37, 43, 68, 73, 77, 118, 150, 181, 229, 310, 311, 328, 329, 340, 356, 358, 380, 403, 440.

C. College and adult

1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 36, 37, 38, 40, 41, 42, 44, 46, 48, 49, 50, 52, 53, 54, 55, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 69, 70, 71, 72, 74, 75, 76, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 117, 119, 120, 122, 123, 124, 125, 126, 128, 129, 130, 131, 133, 134, 135, 136, 137, 138, 139, 140, 141, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 159, 160 161, 162, 165, 168, 171, 172, 173, 175, 176, 177, 178, 179, 180,

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III. Test Material

A. Letters

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B. Trigrams and other nonwords

1, 3, 4, 6, 21, 22, 40, 64, 115, 120, 135, 142, 154, 157, 176,
177, 183, 184, 196, 197, 222, 232, 236, 283, 284, 285, 311, 328,
332, 333, 334, 335, 336, 337, 339, 340, 353, 357, 371, 379, 380,
387, 395, 399, 400, 425, 427, 437.

C. Words

2, 5, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 23, 25, 26, 27,
28, 29, 30, 31, 32, 33, 34, 36, 37, 38, 40, 41, 42, 43, 44, 46,
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D. Sentences and connected discourse

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194, 217, 224, 234, 248, 299, 317, 318, 319, 320, 322, 323, 324,
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IV. Test Material Relationship

A. Formal and acoustic similarity

1, 3, 4, 5, 6, 8, 10, 13, 14, 15, 16, 20, 21, 22, 33, 36, 38,
42, 43, 44, 46, 48, 49, 50, 51, 63, 64, 65, 66, 69, 70, 71, 72,
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382, 387, 389, 393, 395, 396, 399, 404, 409, 414, 415, 416, 417,
418, 419, 420, 425, 427, 431, 432, 437, 439, 440.

B. Semantic, associative, and categorical similarity

2, 7, 9, 10, 11, 13, 14, 15, 17, 19, 20, 23, 24, 25, 26, 27, 28,
29, 30, 31, 32, 34, 37, 38, 40, 43, 46, 47, 48, 52, 53, 54, 55,
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396, 397, 398, 399, 401, 403, 404, 405, 406, 409, 411, 412, 413, 426,
427, 428, 429, 431, 433, 434, 435, 436, 438, 439, 441.

V. Learning Task

A. Free

2, 6, 8, 21, 25, 26, 27, 28, 29, 30, 31, 33, 34, 37, 38, 43, 46, 48, 49, 51, 52, 53, 54, 55, 57, 58, 59, 60, 61, 62, 65, 80, 81, 82, 83, 87, 89, 90, 91, 92, 93, 98, 101, 104, 108, 109, 110, 112, 113, 117, 118, 123, 124, 125, 126, 128, 137, 138, 139, 140, 143, 145, 147, 148, 149, 150, 151, 152, 154, 156, 161, 165, 166, 167, 168, 169, 170, 174, 181, 183, 186, 187, 188, 189, 190, 191, 193, 198, 203, 209, 210, 211, 214, 215, 216, 217, 218, 224, 225, 229, 230, 234, 239, 244, 245, 246, 248, 249, 250, 251, 255, 256, 257, 258, 265, 267, 269, 271, 275, 277, 283, 288, 292, 295, 297, 298, 299, 305, 306, 308, 310, 312, 313, 314, 315, 316, 319, 320, 322, 323, 324, 327, 329, 331, 342, 343, 347, 356, 357, 363, 365, 367, 370, 374, 379, 380, 381, 383, 384, 393, 396, 397, 399, 401, 403, 405, 406, 411, 412, 425, 428, 432, 433, 434, 435, 436, 441.

B. Paired associate

1, 5, 7, 17, 18, 20, 22, 23, 32, 36, 40, 42, 44, 47, 64, 85, 96, 97, 99, 100, 102, 114, 121, 129, 135, 142, 144, 157, 159, 172, 176, 179, 180, 182, 184, 185, 194, 196, 197, 201, 212, 232, 254, 259, 264, 278, 279, 281, 282, 284, 285, 289, 290, 293, 302, 309, 311, 317, 318, 325, 328, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 348, 349, 350, 354, 355, 357, 361, 368, 371, 377, 382, 390, 394, 395, 398, 400, 406, 431, 438.

C. Serial

14, 15, 16, 27, 131, 325, 369.

D. STM (Peterson)

3, 4, 13, 18, 50, 63, 65, 69, 70, 71, 72, 73, 74, 75, 76, 77, 79, 115, 153, 155, 171, 173, 175, 177, 178, 192, 195, 226, 227, 228, 233, 235, 236, 237, 238, 239, 267, 270, 272, 273, 274, 294, 301, 326, 344, 345, 346, 351, 353, 385, 386, 387, 388, 413, 414, 415, 416, 417, 418, 419, 420, 426, 427, 437.

E. Continuous presentation

9, 10, 11, 24, 67, 86, 106, 111, 130, 162, 208, 219, 221, 231, 241, 243, 253, 263, 303, 358, 391, 403, 404, 439.

VI. Retention Interval

A. Immediate recall (only when the amount to be recalled is within the immediate memory span)

2, 3, 4, 13, 15, 16, 33, 34, 36, 37, 44, 49, 50, 63, 65, 67, 69, 70, 71, 72, 74, 75, 76, 77, 79, 81, 82, 83, 90, 91, 92, 93, 98, 99, 115, 158, 155, 165, 171, 173, 174, 175, 177, 178, 186, 191, 192, 226, 227, 228, 233, 235, 236, 237, 272, 273, 274, 276, 292, 301, 312, 315, 326, 344, 345, 346, 353, 356, 414, 416, 417, 418.

B. Delay less than one hour

3, 4, 6, 7, 8, 9, 10, 11, 14, 16, 17, 18, 20, 21, 22, 24, 25, 26, 27, 28, 29, 30, 31, 32, 38, 40, 42, 43, 46, 48, 51, 52, 53, 54, 55, 58, 59, 60, 61, 62, 64, 66, 73, 80, 81, 82, 86, 87, 89, 96, 97, 99, 101, 104, 106, 108, 109, 110, 111, 112, 113, 114, 117, 118, 123, 124, 125, 126, 128, 130, 138, 139, 140, 143, 145, 147, 148, 149, 150, 151, 152, 156, 159, 161, 162, 166, 167, 168, 169, 170, 173, 176, 180, 181, 183, 187, 188, 189, 190, 193, 194, 195, 197, 198, 203, 208, 209, 210, 211, 212, 214, 215, 216, 217, 218, 219, 221, 224, 225, 229, 230, 231, 234, 238, 241, 243, 244, 245, 246, 248, 249, 250, 251, 253, 254, 255, 256, 257, 258, 263, 264, 265, 267, 269, 270, 271, 275, 277, 282, 283, 284, 285, 288, 289, 292, 293, 295, 297, 298, 299, 302, 303, 305, 306, 308, 309, 310, 313, 314, 316, 319, 320, 322, 323, 324, 327, 328, 329, 331, 336, 342, 343, 347, 348, 350, 351, 353, 357, 358, 363, 365, 367, 368, 369, 370, 371, 374, 379, 381, 383, 384, 385, 386, 387, 388, 391, 393, 396, 397, 399, 401, 403, 404, 405, 406, 411, 412, 413, 415, 419, 420, 425, 426, 427, 428, 432, 433, 434, 435, 436, 437, 439, 440, 441.

C. Delay over one hour

1, 7, 23, 27, 42, 55, 102, 172, 196, 246, 311, 380, 390, 394, 395, 396, 438.

VII. Response Variables

A. Free recall

2, 3, 4, 6, 18, 21, 25, 26, 28, 29, 30, 31, 33, 37, 42, 43, 51, 55, 57, 58, 59, 60, 61, 79, 80, 81, 82, 83, 89, 101, 108, 109, 110, 112, 113, 115, 117, 123, 125, 126, 137, 138, 139, 140, 145, 147, 148, 149, 150, 151, 154, 156, 161, 170, 173, 174, 181, 183, 188, 189, 190, 193, 197, 198, 203, 209, 210, 214, 215, 216, 218, 224, 225, 229, 230, 236, 238, 244, 245, 248, 249, 250, 251, 255, 256, 257, 258, 270, 271, 275, 277, 283, 285, 288, 292, 295, 298, 299, 305, 306, 310, 312, 313, 316, 322, 323, 324, 327, 329, 331,

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388, 393, 399, 401, 405, 406, 411, 412, 419, 425, 426, 428, 434,
435, 436, 437, 441.

B. Ordered recall

8, 13, 14, 15, 16, 21, 27, 50, 62, 65, 66, 69, 70, 71, 72, 73,
74, 75, 76, 77, 90, 91, 92, 93, 98, 104, 153, 155, 171, 175,
177, 183, 187, 191, 192, 195, 226, 227, 228, 239, 272, 273, 277,
295, 297, 301, 314, 320, 344, 345, 365, 374, 381, 384, 413, 414,
415, 416, 417, 418, 427, 433.

C. Cued or paced recall

1, 7, 17, 18, 20, 22, 23, 25, 32, 36, 38, 40, 44, 52, 53, 54, 55,
68, 89, 96, 97, 99, 102, 112, 114, 137, 139, 143, 152, 154,
159, 165, 172, 176, 178, 180, 186, 194, 196, 197, 211, 212, 233,
235, 254, 264, 267, 269, 274, 282, 284, 289, 293, 302, 309, 311,
315, 319, 328, 347, 348, 357, 363, 368, 369, 371, 390, 394, 395,
397, 399, 412, 432, 434, 438.

D. Recognition

9, 10, 11, 24, 36, 37, 46, 48, 49, 63, 67, 68, 87, 106, 118, 128,
130, 143, 162, 166, 167, 168, 169, 200, 205, 208, 210, 217, 222,
234, 237, 246, 249, 253, 265, 267, 299, 303, 308, 323, 326, 330,
342, 343, 346, 350, 375, 391, 396, 403, 404, 420.

E. Nonverbal

86, 95, 111, 219, 221, 231, 241, 242, 243, 263, 27[illegible], 307, 333,
334, 335, 337, 338, 339, 352, 358, 389, 440.

1. Abra, J.C. Acquisition and retention of consistent associative responses with varied meaningfulness and similarity of stimuli. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 647-652.

This study investigated learning and retention with the Method of Generated Responses (MGR), in which S produced the responses he was to associate to stimuli. Control Ss learned the lists generated in MGR by conventional paired-associate learning (PAL). Four eight-trigram lists represented two levels of meaningfulness (M) and of formal similarity. Speed of reaching criterion was retarded at high similarity and low M. Learning method did not affect overall rate of learning, nor did it interact with other variables. However, while the criterion was reached more slowly in MGR, performance following the first correct trial was better than in PAL. High final levels of performance precluded firm conclusions concerning forgetting rates.

2. Abramczyk, R.R., & Bousfield, W.A. Sequential ordering in repeated free recall as a function of interitem associative strength. *Psychological Record*, 1967, 117, 183-192.

A modification of Tulving's method served for appraising the relationship between sequential ordering in repeated free recall and interitem associative strength, IIAS. Multiple randomizations of three of Deese's word-lists having *zero*, *low* and *high* IIAS respectively, were presented to separate groups of Ss for a fixed number of presentation-recall trials. Partial support was obtained for the hypothesis that the rate at which ordering develops in repeated free recall as indicated by the occurrence of the same word-bigram units on pairs of successive recalls should vary as a positive function of IIAS. While ordering was substantial for all lists and increased as a function of IIAS, only the *zero* and *high* conditions differed significantly. The items constituting the word-bigrams repeated in successive pairs of recalls varied significantly more in the *high* and *low* than in the *zero* conditions. Words from the *high* were significantly less prone to oscillation in recall than those from the *zero* List. Possible explanations of these findings are considered.

3. Adams, J.A., Thorsheim, H.I., & McIntyre, J.S. Item length, acoustic similarity, and natural language mediation as variables in short-term memory. *Journal of Experimental Psychology*, 1969, 80(1), 39-46. (a)

Four experiments on short-term retention are reported. Retention is known to be an inverse function of number of elements in the item, and Exp. I inquired if this finding is a function of the ease with which natural language mediators (NLMs) are formed. Acoustic similarity and item length were variables in Exp. I.

The NLMs functioned as hypothesized, but a confounding with associative strength precluded a theoretical decision about the number-of-elements variable. The effects of acoustic similarity were essentially absent. Experiments II-IV pursued other aspects of acoustic similarity, and the effects of it were small and unsystematic. A need for clarifying the role of the acoustic similarity variable is discussed.

4. Adams, J.A., Thorsheim, H.I., & McIntyre, J.S. Short-term memory and acoustic similarity. *Psychonomic Science*, 1969, 15(2), 77-78. (b)

In a STM paradigm, four groups of 96 Ss each had all combinations of low and high acoustic similarity of items and sequential and simultaneous modes of presentation. Acoustic interference occurred as a proactive inhibition effect of prior items and then only for the sequential mode and an immediate retention test. Acoustic interference was absent at a 30-sec test, showing its short life.

5. Allen, Doris V. Acoustic interference in paired-associate learning as a function of hearing ability. *Psychonomic Science*, 1970, 18(4), 231-233.

Qualitative differences in coding verbal materials were postulated between normal- and impaired-hearing children. Acoustic similarity was used in two paired-associate lists differing in manner of pairings. The regression of performance upon hearing loss was significant for consistent pairings but not for inconsistent pairings. The results supported the hypothesized qualitative differences.

6. Allen, M., Puff, C.R., & Weist, R. The effects of associative and coding processes on organization in free recall. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 531-538.

The effects of associative and coding processes on organization in multi-trial free recall were investigated. Two variables, formal similarity and list length, were manipulated. The results showed that high formal similarity and shorter list lengths led to less organization in Ss' recall. Both associative and coding effects were demonstrated, suggesting that Ss can process verbal information of this type at two levels. At one, S detects and stores information concerned with the "codability" of the items while at another he attempts to form associative connections among the items of each coded category.

7. Amster, Harriett, Keppel, G., & Meyer, Ann. Learning and retention of letter pairs as a function of association strength. *American Journal of Psychology*, 1970, 83(1), 22-39.

Three experiments on paired-associate learning and retention of letter pairs tested the Underwood-Postman hypothesis that extraexperimental associations interfere with learning and produce forgetting. As hypothesized, in experiments with seven- and ten-year-old children and with adults, highly associated (high-strength) letter pairs were learned faster and, on the whole, retained better over one week than low-strength pairs. The positive retention effects, not observed in previous studies, are partly attributed to the use of the correction procedure as a control for the overlearning of easy items in low-strength lists that is unavoidable with standard methods. This overlearning is believed to reduce the probability of detecting any differential retention of high- and low-strength lists. Developmental differences in children were small for original learning and insignificant for forgetting. A single postcriterion trial, however, facilitated retention-test performance. Theoretical implications are discussed.

8. Anderson, Nancy S. The influence of acoustic similarity on serial recall of letter sequences. *Quarterly Journal of Experimental Psychology*, 1969, 21, 248-255.

Acoustic similarity is known to impair short-term memory (STM) for letter sequences. The present series of experiments investigated the effects of acoustic similarity on long-term retention. In the first experiment, subjects were asked to learn one of two lists of 8 letters, the letters being either of high or low acoustic similarity. Lists were visually presented for three trials, with subjects responding after each trial. Then subjects participated in an immediate memory task for digits which lasted for 20 min. Finally, subjects tried to recall the list of letters they had learned previously. Lists having items of high acoustic similarity were more difficult to recall on the first trial, but were better recalled on the delayed retention test. In a second experiment, groups of subjects were again asked to learn one of two lists of 8 letters differing in acoustic similarity, using different orders of the letters used previously. The procedures were identical except that in two groups, a STM task for digits intervened between the presentation and test of the letters. This intervening task minimized the effects of STM and eliminated the differences in retention found previously. In a third experiment, better long-term retention for material having high acoustic similarity was also obtained when subjects used a backward recall procedure. In the last experiment 14 item lists were learned to a criterion of two correct trials,

and retention was tested after each trial and at a delay of 20 min. and 23 hr. No effect of acoustic similarity was found and little retention loss occurred. These results suggest that reducing the STM component by introducing a STM control or by lengthening the list caused the effect of acoustic similarity to disappear.

9. Anderson, S.W., & Beh, W. The reorganization of verbal memory in childhood. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 1049-1053.

Two experiments in short-term recognition for familiar words were performed to investigate the hypothesis that verbal memory in adults is lexically coded, and that the paradigmatic shift in children's free associations is a symptom of the acquisition by the 7-year-old of this lexical memory system. Both results were positive. Syntagmatic linking, on the other hand, was found to influence recognition memory selectively only among children who had not yet undergone the shift. These results were held to be compatible with the explanation that the shift is accompanied by an increase in storage efficiency.

10. Anisfeld, M. False recognition produced by semantic and phonetic relations under two presentation rates. *Psychonomic Science*, 1969, 17(6), 366-367.

College students listened to a list of 220 words at 2- and 5-sec. presentation rates. They had to indicate for each word whether it had appeared before in the list ("yes") or not ("no"). No differences were found between the conditions, because, it appears, Ss failed to use in a task-relevant manner the extra time available to them in the longer condition. Words related either semantically or phonetically to previously heard words produced more false-recognition errors (i.e., "yes" responses to new words) than control words, suggesting that phonetic traces, not only semantic ones, persist for at least 5 min. (this being the maximum separation between a preceding word and a related word).

11. Anisfeld, M., & Knapp, Margaret. Association, synonymity, and directionality in false recognition. *Journal of Experimental Psychology*, 1968, 77(2), 171-179.

When asked to indicate whether each of 200 orally presented words had appeared before (+) or not (--), students gave more plusses to common associates and synonyms of preceding words than to control words. In a 2nd experiment, false recognition

errors were obtained when the preceding words associatively elicited the test words and when the associative relation was bidirectional but not when only the test words elicited the preceding words. The results of the 2nd experiment were taken as an indication that initial coding of words contributes to false recognition and that the phenomenon is not merely an artifact of testing for it. The occurrence of false recognition errors was taken as support for a characterization of words as complexes of attributes or features.

12. Atkinson, R.C., & Shiffrin, R.M. Human memory: A proposed system and its control processes. In Spence K.W., & Spence, J.T. *The Psychology of Learning and Motivation.* Vol. 1. New York: Academic Press. pp. 89-195.

*13. Baddeley, A.D. Semantic and acoustic similarity in short-term memory. *Nature*, 1964, 204, 1116-1117.

Five word acoustically similar, acoustically different, semantically similar or semantically different sequences were presented by tape recorder at the rate of one word per second. At the end of each sequence, Ss were allowed 20 seconds to write as much as they could recall in the appropriate order.

Performance on the acoustically and semantically similar sequences was poorer than on the respective dissimilar sequences, and the detrimental effect of acoustic similarity was significantly greater than that of semantic similarity.

14. Baddeley, A.D. The influence of acoustic and semantic similarity on long-term memory for word sequences. *Quarterly Journal of Experimental Psychology*, 1966, 18, 302-309. (a)

It has been shown that short-term memory (STM) for word sequences is grossly impaired when acoustically similar words are used, but is relatively unaffected by semantic similarity. This study tests the hypothesis that long-term memory (LTM) will be similarly affected. In Experiment I subjects attempted to learn one of four lists of 10 words. The lists comprised either acoustically or semantically similar words (A and C) or control words of equal frequency (B and D). Lists were learned for four trials, after which subjects spent 20 min. on a task involving

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*Abstracted from method and discussion sections.

immediate memory for digits. They were then asked to recall the word list. The acoustically similar list was learned relatively slow, but unlike the other three lists showed no forgetting. Experiment II showed that this latter paradox can be explained by assuming the learning score to depend on both LTM and STM, whereas the subsequent retest depends only on LTM. Experiment III repeats Experiment I but attempts to minimize the effects of STM during learning by interposing a task to prevent rehearsal between the presentation and testing of the word sequences. Unlike STM, LTM proved to be impaired by semantic similarity but not by acoustic similarity. It is concluded that STM and LTM employ different coding systems.

15. Baddeley, A.D. Short-term memory for word sequences as a function of acoustic, semantic, and formal similarity. *Quarterly Journal of Experimental Psychology*, 1966, 18, 362-365. (b)

Experiment I studied short-term memory (STM) for auditorily presented five word sequences as a function of acoustic and semantic similarity. There was a large adverse effect of acoustic similarity on STM (72.5 per cent) which was significantly greater ($p < 0.001$) than the small (6.3 per cent) but reliable effect ($p < 0.05$) of semantic similarity.

Experiment II compared STM for sequences of words which had a similar letter structure (formal similarity) but were pronounced differently, with acoustically similar but formally dissimilar words and with control sequences. There was a significant effect of acoustic but not of formal similarity.

Experiment III replicated the acoustic similarity effect found in Experiment I using visual instead of auditory presentation. Again a large and significant effect of acoustic similarity was shown.

16. Baddeley, A.D. How does acoustic similarity influence short-term memory? *Quarterly Journal of Experimental Psychology*, 1968, 20, 249-264.

This study attempts to discover why items which are similar in sound are hard to recall in a short-term memory situation. The input, storage, and retrieval stages of the memory system are examined separately. Experiments I, II and III use a modification of the Peterson and Peterson technique to plot short-term forgetting curves for sequences of acoustically similar and control words. If acoustically similar sequences are *stored* less efficiently, they should be forgotten more rapidly. All three experiments show a parallel rate of forgetting for acoustically similar and

control sequences, suggesting that the acoustic similarity effect does not occur during storage. Two input hypotheses are then examined, one involving a simple sensory trace, the other an overloading of a system which must both discriminate and memorize at the same time. Both predict that short-term memory for *spoken* word sequences should deteriorate when the level of background noise is increased. Subjects performed both a listening test and a memory test in which they attempted to recall sequences of five words. Noise impaired performance on the listening test but had no significant effect on retention, thus supporting neither of the input hypotheses. The final experiments studied two retrieval hypotheses. The first of these, Wickelgren's phonemic-associative hypotheses attributes the acoustic similarity effect to inter-item associations. It predicts that, when sequences comprising a mixture of similar and dissimilar items are recalled, errors should *follow* acoustically similar items. The second hypothesis attributes the effect to the overloading of retrieval cues which consequently do not discriminate adequately among available responses. It predicts maximum error rate *on*, not following, similar items. Two experiments were performed, one involving recall of visually presented letter sequences, the other of auditorily presented word sequences. Both showed a marked tendency for errors to coincide with acoustically similar items, as the second hypothesis would predict. It is suggested that the acoustic similarity effect occurs at retrieval and is due to the overloading of retrieval cues.

17. Baddeley, A.D., & Dale, H.C.A. The effect of semantic similarity on retroactive interference in long- and short-term memory. *Journal of Verbal Learning and Verbal Behavior*, 1966, 5, 417-420.

Experiment I showed RI effects in long-term memory for pairs of adjectives in the classical RI paradigm (Learn A-B, Learn A'-C, Retest A-B, where A and A' are adjectives with similar meanings). Experiment II tried to show comparable RI effects in short memory. Sequences of three pairs were presented once and tested immediately. As in Exp. I, pairs of adjectives were used, with experimental trials containing pairs with semantically similar stimuli and control trials comprising pairs with dissimilar stimuli. There was no significant difference between recall of RI items and their controls. Experiment III extended this study to lists of 2, 4 and 6 pairs. Again there was no reliable evidence for RI effects of the type shown in long-term memory.

18. Baddeley, A.D., & Warrington, Elizabeth K. Amnesia and the distinction between long- and short-term memory. *Journal of Verbal Learning and Verbal Behavior*, 1970, 9, 177-189.

Evidence for a dichotomy between long-term memory (LTM) and short-term memory (STM) comes from: (a) amnesic patients with a normal digit span but defective LTM, and (b) tasks comprising two components, one labile (STM) and the other stable (LTM). This study examines the compatibility of (a) and (b) by comparing the performance of amnesic and control Ss on immediate and delayed free recall, the Peterson short-term forgetting task, development of PI in STM, minimal paired-associate learning, digit span, and the Hebb repeated digit-sequence technique. Results suggest that amnesic Ss have normal STM but defective LTM. There is some evidence of a stable component in certain STM tasks, on which amnesic Ss are also unimpaired. Implications for the dichotomy between STM and LTM are discussed.

*19. Barch, A.M., & Whalen, C. Intrapair relations in verbal discrimination learning: Confirmation of paradoxical results. *American Psychological Association, Proceedings of annual meeting*, 1970, 59-60.

In verbal discrimination (VD) learning, S must learn which item of a pair of verbal items is "correct" according to E. Intrapair similarity--whether physical, semantic, or associative--should make this discrimination more difficult. This expectation follows both from general association theory and also from the frequency theory of VD learning of Ekstrand, Wallace, and Underwood (1966).

But less VD errors were made on pairs of highly associated words (A pairs) than on unrelated pairs (U pairs by fourth- through eight-grade children in a previous study (Barch, Lippmann, & Whalen, 1967). Even word pairs with similar sound (SS) were equivalent to U pairs in VD errors rather than inferior. The A pairs that displayed faster VD learning included contrast, coordinate, and synonymous relations.

The primary purpose of the present study was to compare VD learning on A pairs, SS pairs, and U pairs in a separate list design. The relative difficulty of different kinds of A pairs was also studied.

Three 18-pair VD lists were constructed. Each list had five adjective pairs, five noun pairs, two verb pairs, and two function word pairs. The continuation and synonym classes could not be duplicated on Lists SS and U without changing their nature.

Pair position in a list and pair sequence was counterbalanced across study and test trials (ST and TTs) and across testing stage for each list.

Both STs and TTs were recorded by E on low-print tape using an Ampex 606-2 system. A 5-sec. presentation rate per pair was used on all trials. About 1 sec. was required for saying each word of the pair. On STs, 2.5 sec. after the beginning of a pair, the C item was repeated and identified as correct (e.g., "beautiful is correct"). TTs consisted of the sequential number of each pair followed by the pair itself (e.g., "25, pretty-beautiful"). The same taped master of the TTs was used for the Key A and B versions. The intertrial interval was 10 sec.

Each group of Ss received three alternating STs and TTs on each list. From 5 to 8 min. intervened between lists. Ss responded on two-choice IBM answer sheets, marking the first column if the firt word of the test pair was the C item and marking the second column if the second word of the pair was correct.

Performance on the A list was equivalent for all grades and superior to performance on all other lists for all other grades at the .01 level. Grade 6 performed better than Grade 4 on Lists SS and U. Within a grade level, performance on Lists SS and U was equivalent.

The Newman-Keuls comparison showed List A significantly easier at the .01 level than List U for Grades 4 and 5 but not 6. No other difference was significant. This limited analysis has no control for the wide individual differences in VD performance.

20. Bastian, J. Associative factors in verbal transfer. *Journal of Experimental Psychology*, 1961, 62(1), 70-79.

Transfer and recall of lists of paired associates were compared in situations in which the original and subsequent lists had identical stimulus words but in which the response words were variously related. The response words in the different lists were either strongly associated but not similar in meaning, highly similar in meaning but not associated, both similar in meaning and associated, or neither similar in meaning nor associated.

The results indicated that positive transfer occurred whenever the words were linked by associative connections, irrespective of semantic relations. Some positive transfer also occurred to a lesser extent across words highly similar in meaning but only weakly associated. It was suggested that the latter result was due to a temporary supplementation of some of the interlist associations connecting these words.

The results suggested a formulation of verbal generalization in which the tendency for the occurrence of the generalized responses is increased because of their associative connections to the responses learned in the original task. On the basis of this formulation, generalization between words judged to be similar in meaning occurs only because associative tendencies connecting them are usually present in Ss' verbal behavior.

21. Battig, W.F. Effect of sequential blocking of similar trigrams on free and serial recall. *Psychonomic Science*, 1966, 5(10), 369-370.

Recall performance on 15-item lists consisting of three letter orders of each of five three-letter anagrams was markedly facilitated if the letter orders of each set were blocked rather than unsystematically ordered during presentation, and/or Ss were permitted free recall of the items in any order. The blocking effect was larger in magnitude, and also eliminated the superiority of free over serial recall.

22. Battig, W.F., & Brackett, H.R. Transfer from verbal-discrimination to paired-associate learning: II. Effects of intralist similarity, method, and percentage occurrence of response members. *Journal of Experimental Psychology*, 1963, 65(5), 507-514.

In agreement with previous results, paired-associate (PA) performance was not significantly facilitated on pairs identical to those of a previous verbal-discrimination (VD) list, whereas poorer performance resulted if the VD and PA items were paired differently, as compared with PA items exluded from the VD list. These transfer effects were unaffected by intralist similarity or percentage occurrence of response members (ORM), but were largely eliminated under the recall method of PA learning. Contrary to previous findings, overall recall-method PA performance was only insignificantly superior to that under the standard anticipation method. Moreover, a contrasting distinct superiority of the anticipation method was found under conditions of 50% ORM, especially for medium intralist similarity.

23. Beecroft, R.S. Verbal learning and retention as a function of the number of competing associations. *Journal of Experimental Psychology*, 1956, 51(3), 216-221.

Previous studies of verbal learning have indicated that interference in learning increases with the number of competing associations. Four paired adjective lists, varying in the number of competing associations per pair, were learned by the anticipation method and recalled 24 hr. after learning. The results agree with previous findings that competing associations handicap performance early in learning and that intralist similarity does not affect recall.

24. Begg, I., & Paivio, A. Concreteness and imagery in sentence meaning. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 821-827.

Previous research has shown that Ss recognize semantic changes in sentences more readily than changes in their wording when meaning remains unchanged. The present experiment yielded the same results for concrete sentences. In the case of abstract sentences, however, changes in wording were more noticeable than semantic changes. These findings are consistent with the hypothesis that concrete sentences are coded and stored primarily as nonverbal images that retain the meaning but not the wording of the sentences, whereas abstract sentences are stored primarily in their verbal form.

25. Bilodeau, E.A. Experimental interference with primary associates and their subsequent recovery with rest. *Journal of Experimental Psychology*, 1967, 73(3), 328-332.

144 Ss were trained on 5 word-association primaries for List 1 and then on the 5 corresponding secondaries for List 2. During recall for List 1, 1/2 of the Ss were tested for free recall and the remainder for stimulated recall (that is, the stimulus corresponding to the primary and secondary was present). Also, 1/2 of the Ss were tested with a short or a long retention interval. Recall of primaries under stimulated conditions, but not under free recall, was better with the longer interval, confirming the experimental hypothesis. The results supported the view that List 2 was a short-term source of interference that temporarily disrupted the retrieval of List 1 and that later, the longer retention interval permitted the interference to fade and allowed the substitution of List 1 for List 2.

26. Bodin, A.M., Crapsi, L.A., Deak, Marilyn R., Morday, T.R., & Rust, L.D. Prediction of free recall from word-association measures: A replication. *Journal of Experimental Psychology*, 1965, 69(1), 103-105.

Mean recall frequency of 99 Kent-Rosanoff words was investigated as a function of cue number, a measure of intralist association. Word cards were shuffled and viewed for 5 sec. each by 15 female and 13 male undergraduate Ss, 17-19 yr. old. Following a 15-min. rest, Ss had 5 min. for written recall. Results showed a significant relationship between cue number (Nc) and mean recall frequency. Peaks and valleys graphed from replication and original data matched and coincided with Nc's unique to one word, suggesting these fluctuations reflect particular, not random effects. Cue linkage increased with Nc and depended on association strength between cuing and cue-linked words, replicating original findings, and, originally unreported, favored early recall.

*27. Bourne, L.E., Jr., & Parker, B.K. Interitem relationships, list structure, and verbal learning. *Canadian Journal of Psychology*, 1964, 18(1), 52-61.

Two experiments were performed to gather additional evidence on organizational bases in verbal learning through observation of the effects of some variables designed to influence the usefulness of various interitem relationships to a learner. In Experiment I, two basic relationships among items, labelled here concept and sentence structure, were employed in the construction of lists to be learned by the method of free recall. These lists were presented to the S either successively or simultaneously with the prediction that, as in concept learning, simultaneous presentation would promote the use of available relationships and thus produce faster learning. Furthermore, two orders of list presentation, one based on the existing intralist relationships and the other in which the words were arranged unsystematically, were used to determine the effect of obviousness of structure

Experiment II was undertaken to obtain information about the effects of list structure, uncontaminated by word differences, on serial verbal learning. In this study the same words were ordered in different sequences to emphasize different organizatinal properties.

The results clearly indicate that interitem relationships within a list of verbal materials may facilitate the learning of those materials, either by the method of free recall (Experiment I) or serial learning (Experiment II). In Experiment I, structured list, whether systematically or unsystematically presented, were learned more efficiently than random lists. The two experiments yield contrary findings with respect to which type of list structure, concept (Experiment I) or sentence (Experiment II), is more facilitative to verbal learning, and the available data provide little basis for a choice among possible explanations.

28. Bousfield, W.A., Esterson, J., & Whitmarsh, G.A. A study of developmental changes in conceptual and perceptual associative clustering. *Journal of Genetic Psychology*, 1958, 92, 95-102.

This study deals with the developmental changes in associative clustering when subjects are given the alternatives of clustering on the basis of either conceptual categories of meaning or perceptual categories of color. The following experimental hypotheses were tested: (a) Older subjects should show a greater total amount of clustering than younger ones. (b) Older subjects should show a smaller percentage of color clustering than younger ones. (c) Older subjects should recall more stimulus-items than younger ones. The method involved the use of 25 names of objects

printed below their colored pictures. The items were such as to be classifiable on the basis of five categories of meaning (birds, fruits, flowers, nature, vegetables) and also on the basis of color (green, purple, red, white, yellow). Colored slides of these items were exposed on a screen in random order with instructions to recall as many items as possible in the order of their occurrence in memory. Clustering was indicated by sequences of recalled items belonging in the same category of meaning or color. The subjects were 20 college students, 17 4th grade children 10 years of age, and 15 3rd grade children 9 years of age. Analyses of the data indicated support for the experimental hypotheses relating to total clustering and number of stimulus-items recalled. The results for percentage of color clustering indicated an unexpected inversion with the smallest amount for the 4th grade subjects. Though the results for color failed to attain statistical significance, their trend paralleled Rorschach norms for Σ C scores. The authors conclude that the extent of use of any specified basis for the organization of responses must depend not only upon the nature of alternative modes of organization, but also upon simultaneously operating sets or attitudes.

29. Bousfield, W.A., & Puff, C.R. Clustering as a function of response dominance. *Journal of Experimental Psychology*, 1964, 67(1), 76-79.

This experiment was designed to test the predicted effectiveness of response dominance as assessed by Underwood and Richardson for inducing clustering in free recall. A randomized list of 24 words including 8 items representing a given concept at a high dominance level was presented to 34 Ss. For 24 Ss, 8 words representing the given concept at a low dominance level replaced the high dominance words of the 1st list. Significant clustering was found only for the high dominance words. A new formula was used for assessing the incidence of clustering.

30. Bousfield, W.A., & Puff, C.R. Determinants of the clustering of taxonomically and associatively related word pairs. *Journal of General Psychology*, 1965, 73, 211-221.

Each of two matched groups of 36 Ss was tested for clustering in recall of a randomized list of 13 pairs of related words. With pairs of words matched for associative strength, Group 1 (given taxonomically related pairs) clustered more than Group 2 (given nontaxonomically related pairs). Using 27 measures of word relatedness, the authors found that the taxonomic pairs were higher than the nontaxonomic pairs in the measures of indirect association. A variety of measures correlated highly with the clustering of the individual nontaxonomic pairs, but there were no significant correlations for the taxonomic pairs.

31. Bousfield, W.A., Whitmarsh, G.A., & Berkowitz, H. Partial response identities in associative clustering. *Journal of General Psychology*, 1960, 63, 233-238.

Associative clustering has been defined as the tendency of Ss to recall the items of a randomized stimulus word list in sequences of related words. The present study employed associative clustering as a device for determining the validity of an index of word relatedness based on partial response identities. This index, independently derived by Cofer and designated by him as the mutual frequency score, is the percentage of implicit verbal responses which two verbal stimuli have in common. The unique feature of this measure is that it includes what Bousfield, Cohen, and Whitmarsh have termed the representational response. Since this response is assumed to be uniquely representative of any given word, it is labelled as the word itself. Evidence of the validity of the mutual frequency score was found in an obtained positive correlation between such scores for pairs of words and the incidence of the clustering of these pairs in free recall.

32. Bousfield, W.A., Whitmarsh, G.A., & Danick, J.J. Partial response identities in verbal generalization. *Psychological Reports*, 1958, 4, 703-713.

This paper separately presents an outline of a theoretical rationale to account for verbal generalization, and a report of an experiment the results of which are interpreted as supporting the proposed theory. Generalization is treated in reference to the following conditions: when an observable response has been trained to a given stimulus word, such a response may to varying degrees be elicited by a second by related stimulus word used for testing the presence of generalization. The theoretical account is an amplified version of postulates of Bousfield, Cohen, and Whitmarsh. A major assumption of this theory is that a given stimulus word typically elicits two types of implicitly produced responses both of which have stimulus properties deriving from feedback. They are (a) a distinctive representational response which may be labelled as the stimulus word itself and (b) a composite of verbal associational responses occurring as a consequence of the representational response. These associational responses may be appraised from free association norms. When an observable response is learned to the given stimulus word, multiple S--R connections are established between this response and the feedback stimuli generated by both the representational and the associational responses to the given stimulus word. After such learning has taken place, a second but related word may be presented to test for the occurrence of generalization. The tested word is assumed to elicit its own implicit representational and associational responses. The tendency for the observable response to occur will

vary directly with the proportion of the associational responses to the tested word that also occur among the representational and the associative responses to the word to which the observable response was learned. In other words, the occurrence of generalization depends on partial response identities. These statements involve the assumption that, while the representational response has stimulus properties, it should be described as non-mediational. The mediational functions are ascribed only to the implicit, associational responses to what may be called the tested word. These postulates serve as a basis for deriving an index of predicted generalization which employs free associational norms for specifying the partial response identities. The paper reports the results of an experimental study making use of groups of 10 pairs of words with one member of each pair serving as the trained word and the other member as the tested word. The observable responses were randomly assigned numbers from 1 to 10. These were attached to the trained words by means of paired-associate learning. Generalization was assumed to occur when a given tested word elicited the number response previously learned to the related trained word. The positive correlations between the indices of predicted generalization for the word-pairs and the extent of generalization experimentally determined for each pair yielded support for the proposed theory. Gross analyses of the reaction times obtained in the testing situation also yielded results consistent with the basic theory.

33. Bousfield, W.A., & Wicklund, D.A. Rhyme as a determinant of clustering. *Psychonomic Science*, 1969, 16(4), 183-184.

This study dealt with rhyme as a determinant of clustering in free recall. The stimuli comprised 12 rhyming pairs of words. The results from 30 Ss showed significant clustering as well as high variance attributable to both Ss and word pairs.

34. Bower, G.H. Chunks as interference units in free recall. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 610-613.

The experiment tested the hypothesis that free recall is limited by the number of chunks that can be reproduced, not the number of words. Recall of a given word should be higher the fewer chunks are required to encompass the remaining words in the list. To test this, a subset of 12 critical words was embedded in a larger list containing 12 fillers composed either of single words, or three-word cliches, or unrelated word triplets. As predicted, recall of the critical words was the same in the single-word and cliche lists, but poorer in the triplet list. Cliches and single words were equally recalled. Total units recalled in the three lists were the same, with only the selection of units differing in recall. The results confirm the chunking hypothesis and have implications for Murdock's (1960) total-time hypothesis about free recall.

35. Bower, G.H. Organizational factors in memory. *Cognitive Psychology*, 1970, 1, 18-46.

The research reviewed illustrates how the structural organization of material influences the way in which it is learned and recalled by the person. Specific factors investigated concerned relational rules and perceptual-conceptual groupings as these appeared in various laboratory learning tasks. The influence of relational rules was illustrated in paired-associate learning in which a list rule, stipulating a particular relation between the nominal stimulus and response terms, enhanced performance and reduced interference from other learning. The apparent role of the S-R pairing rule, inferred from studies of rhyming rules, is to enable restriction of the range of response alternatives which the person needs to consider at crucial points in his recall. The role of perceptual groupings was examined in immediate recall of digit series; conceptual groupings were examined in free recall of word lists. By one or another means, the learning materials are segmented by the subject into integrated groups which become his functional recall units. Recall suffers if the subject is made to adopt new groupings of the same material. The results on digit series were interpreted by the "reallocation" hypothesis, which ties together the perceptual coding of a string and the "memory location" at which its trace is stored, with implications about recognition memory and trial-by-trial increments in recall of the same string. In free recall, the stable groupings of list words which develop are often supplemented by the subject developing a higher-order retrieval scheme to guide his reproduction of the many items on the list. The nature and influence of several retrieval schemes is reviewed, including interchunk associations, pegword mnemonics, semantic category cuing, and hierarchically embedded category systems. These basic schemes provide implicit cues to guide the person's search through memory. Hierarchical schemes, based on recursive associative decoding, are particularly effective retrieval plans. The results are discussed in terms of the advantages of common strategies preferred by human learners, viz., the tendency to subdivide and group material, and to do this recursively, producing a hierarchical organization of the information to be learned.

36. Bower, G.H., & Bolton, Laura S. Why are rhymes easy to learn? *Journal of Experimental Psychology*, 1969, 82(3), 453-461.

The question was why a list of rhyming paired associates is learned faster than a list of unrelated pairs. It is proposed that the rhyming relation restricts the range of response alternatives to the stimulus, practically converting recall into a recognition test. Several tests of this hypothesis proved confirmatory. First, an assonance (change of last phoneme) rule

for pairs, which restricts alternatives about as much as a rhyming rule, facilitated performance as much as did a rhyming rule. Second, when response alternatives were equated by multiple-choice tests for memory, the advantage for rhyming pairs vanished. A third experiment showed that the presence of some rhyming pairs in a list induced S to generalize this rule inappropriately to other pairs, thereby suffering interference on those pairs composed by re-pairing rhyming units.

37. Bower, G.H., Clark, M.C., Lesgold, A.M., & Winzenz, D. Hierarchical retrieval schemes in recall of categorized word lists. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 323-343.

These experiments investigate the effects of hierarchic organization of word-lists upon their free recall. Ss recalled nested category lists presented either randomly or in a hierarchically organized manner. Recall was 2-3 times better with the organized presentation. Later experiments showed this effect (a) was similar with associative as well as conceptual hierarchies, (b) was attenuated with recognition tests of memory, and (c) could not be accounted for by associative "guessing." Another experiment demonstrated retroactive facilitation in recall of List 1 when List 2 contained the hierarchic superordinates of the words on List 1. Analyses suggest that the hierarchic principle was used as a retrieval plan for cuing recall, with generated candidates monitored for their list membership before being overtly recalled.

38. Bregman, A.S. Forgetting curves with semantic, phonetic, graphic, and contiguity cues. *Journal of Experimental Psychology*, 1968, 78(4), 539-546.

Forgetting curves were obtained by presenting nouns 1 at a time in a long sequence with recall tests interspersed in the series. 4 types of cues were used in tests: contiguous nouns, phonetic attributes, graphic attributes, and semantic attributes. Curves obtained with each cue could be factored into an STM and an LTM component. Recall with attribute cues was highest, the relative effectiveness of different ones depending on the retention interval.

39. Broadbent, D.E. Flow of information within the organism. *Journal of Verbal Learning and Verbal Behavior*, 1963, 2, 34-39.

This paper outlines the general approach of drawing inferences about the flow of information inside the organism, and summarizes the evidence for distinguishing short-term from long-term memory. A minor experiment is described, in which short-term memory is compared for items which have been followed by a fixed number of

interfering items at fast and at slow speeds. The latter produced inferior performance, which is consistent with a decay theory. The greatest emphasis is placed, however, upon the different role of similarity in short- and long-term memory.

40. Brown, Lynn K., Jenkins, J.J., & Lavik, Joyce. Response transfer as a function of verbal association strength. *Journal of Experimental Psychology*, 1966, 71(1), 138-142.

9 word nonsense-syllable pairs were well learned by 20 college students. For each original stimulus, there were 3 test stimuli representing 3 degrees of free-association response strength to that stimulus. Test stimuli and control words were interspersed among the original pairs after learning had been achieved. Ss guessed a response to "new" stimuli, using one of the 9 nonsense syllables. A transfer response was scored when S gave the response paired with the original stimulus to which the test stimulus was related. Significant differences in amount of transfer were found between high- and low-strength words, and between all 3 degrees of associative strength and control words. Further, a graph of the log frequency of associative strength against the number of transfer responses made to each class of test stimuli revealed the expected trend.

41. Brown, R., & McNeil, D. The "Tip of the tongue" phenomenon. *Journal of Verbal Learning and Verbal Behavior*, 1966, 5, 325-337.

The "tip of the tongue" (TOT) phenomenon is a state in which one cannot quite recall a familiar word but can recall words of similar form and meaning. Several hundred such states were precipitated by reading to Ss the definitions of English words of low frequency and asking them to try to recall the words. It was demonstrated that while in the TOT state, and before recall occurred, Ss had knowledge of some of the letters in the missing word, the number of syllables in it, and the location of the primary stress. The nearer S was to successful recall the more accurate the information he possessed. The recall of parts of words and attributes of words is termed "generic recall." The interpretation offered for generic recall involves the assumption that users of a language possess the mental equivalent of a dictionary. The features that figure in generic recall may be entered in the dictionary sooner than other features and so, perhaps, are wired into a more elaborate associative network. These more easily retrieved features of low-frequency words may be the features to which we chiefly attend in word-perception. The features favored by attention, especially the beginnings and endings of words, appear to carry more information than the features that are not favored, in particular the middles of words.

42. Bruce, D., & Crowley, J.J. Acoustic similarity effects on long-term memory for paired associates. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 430-433.

Does acoustic similarity between the left-hand members of two paired-associate (PA) lists impair long-term memory (LTM) in a proaction design? Under one treatment, the left-hand terms of the two lists were acoustically similar (e.g., YOUNG-LUNG); under a second treatment, they were not acoustically similar. Either 10 min. 24 hr., or 1 week intervened between the end of List 2 learning and the recall test on List 2. Subsequent to the memory test on List 2, retention of List 1 was also assessed. Neither recall of List 2 nor memory for List 1 was substantially affected by the manipulation in acoustic similarity. For LTM following multitrial training on two full-scale PA lists, it is concluded that both proactive and retroactive inhibition attributable to acoustic similarity between the left-hand terms of the lists are negligible.

43. Bruce, D., & Crowley, J.J. Acoustic similarity effects on retrieval from secondary memory. *Journal of Verbal Learning and Verbal Behavior*, 1970, 9, 190-196.

Secondary memory (SM) was tested by a delayed free-recall procedure. Experimental lists contained sets of four critical words, either acoustically or semantically related, which were either massed in early input positions, massed in late input positions, or distributed throughout a sequence of words. In control lists, critical serial positions were occupied by items which were neither semantically nor acoustically related. Recall of semantically similar words substantially exceeded that of critical control words regardless of how they were presented. By contrast, significant acoustic similarity effects were obtained only when critical words were massed early or late and not when they were distributed throughout a list. Temporal overlap during list presentation of the acoustically related traces in primary memory appears to be a sufficient condition for acoustic information to play an important role during retrieval from SM.

44. Bruce, D., & Murdock, B.B., Jr. Acoustic similarity effects on memory for paired associates. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 627-631.

Experiment I tested the short-term retention of paired associates (PAs) with 6-item PA lists and a probe technique. Acoustic similarity between the left-hand members (e.g., LAMP-RAMP) of specific pairs increased proactive inhibition but not retroactive inhibition (RI). Experiment II, which used the same kind of materials, examined RI in memory for PAs following multi-trial practice on two consecutive

PA lists. Acoustic similarity had no substantial effect on retention of the first list or learning of the second list. These data suggest that, in short-term retention at least, acoustic similarity effects on the memory for PAs are mostly proactive.

45. Buschke, H. Interaction of long term and short term memory. *Journal of Nervous and Mental Disease*, 1968, 147(6), 580-586.

Experimental and theoretical arguments are presented for the view that a more explicit consideration of the *interaction* of long term and short term memory will be necessary for adequate understanding of memory and learning. Some significant aspects of the interaction of distinct but interdependent long term and short term memory are considered in terms of certain salient features of short term and long term storages. This view is supported by experimental findings concerning the nature of information in short term storage, the distinction between short term storage and learning and the role of long term storage in perception and encoding for short term storage.

46. Buschke, H., & Lenon, R. Encoding homophones and synonyms for verbal discrimination and recognition. *Psychonomic Science*, 1969, 14(6), 269-270.

Forced-choice recognition was less accurate for homophones or synonyms than for unrelated words, suggesting that information about both semantic and phonetic attributes of English words may be encoded. Forced-choice discrimination (when both words had been presented together with the correct word underlined) was less accurate than recognition of unrelated words, but was as accurate for homophones and synonyms as for unrelated words, suggesting that information about either semantic or phonetic attributes may be encoded selectively. These findings are consistent with the view that words may be treated as complexes of differential features.

47. Castaneda, A., Fahel, Leila S., & Odom, R. Associative characteristics of sixty-three adjectives and their relation to verbal paired-associate learning in children. *Child Development*, 1961, 32, 297-304.

The present report describes the word associations and the relative frequency with which they occurred in a sample of 82 fourth, fifth, and sixth grade children to a list of 63 common adjectives. Also, two lists composed either of high or low association values between the to-be-learned stimulus and response items were constructed from the standardization list and employed

in a paired-associate learning experiment with fifth and sixth grade children. Learning by the anticipation method was found to be significantly better the higher the association values.

48. Cermak, G., Schnorr, J., Buschke, H., & Atkinson, R.C. Recognition memory as influenced by differential attention to semantic and acoustic properties of words. *Psychonomic Science*, 1970, 19(2), 79-81.

Lists of 264 words were studied by 75 Ss. The Ss were divided into three groups instructed to remember either meaning or sound or both meaning and sound of the study words. During recognition, S was required to indicate which word of each test pair had been presented earlier. The incorrect altarnative for each test pair was a homophone, synonym, or a word unrelated to the correct choice. Recognition increased as instructional emphasis on remembering word meaning increased. Overall recognition was best when the incorrect choice was unrelated to the study word, and worst when the incorrect choice was a synonym of the study word. The high performance levels obtained under some conditions suggest that word features other than semantic and phonetic information are important for word recognition.

49. Chase, W.G., & Calfee, R.C. Modality and similarity effects in short-term recognition memory. *Journal of Experimental Psychology*, 1969, 81(3), 510-514.

The effects of auditory and visual presentation and test modes using the Sternberg recognition memory task were explored in two studies, with modes varied within Ss in Exp. I and between Ss in Exp. II. Memory lists consisted of consonants that were visually or acoustically similar or were neutral. Reaction time was a linear function of memory set size in all conditions, consistent with a serial search model. Search rate was substantially slower when different presentation and test modes were employed (e.g., visual-auditory or auditory-visual) than when the same mode was used. Acoustically similar lists were searched somewhat more slowly in both studies, but the effects of the similarity variable were relatively slight. The results were discussed in terms of the differences in recall and recognition memory.

50. Cimbalo, R.S., & Laughery, K.R. Short-term memory: Effects of auditory and visual similarity. *Psychonomic Science*, 1967, 8(2), 57-58.

The effects of five variables on short-term memory for letters were studied: Auditory Similarity, Visual Similarity, Presentation Rate, Sequence Length, and Blocks of Trials. Performance varied

directly with Presentation Rate and inversely with Sequence Length and Auditory Similarity. Performance improved over blocks with high auditory and high visual similarity, and decreased under the low conditions of these variables. The improvement is attributed to learning to ignore redundant cues and attend to cues that permit discrimination. The decrement is attributed to fatigue and/or waning attention.

51. Cirillo, L.E. Organization in the recall and sorting of verbal materials: An ontogenetic study. *Dissertation Abstracts*, 1965, 26, 2334.

A study was carried out to investigate ontogenetic changes in the modes of organizing verbal materials during recall and sorting. Seventy-two Ss, equally divided among three age groups (8, 10, and 12 years), were tested. Materials consisted of 24 words printed on small, white cards. The word-forms were so constructed as to be amenable to different modes of organization, viz., color of print, number of syllables, graphic similarity, part of speech, syntactic order.

First, S was presented with the cards one at a time in random sequence and asked to recall as many items as possible in any order. This procedure was repeated for a second trial. Next, the words were presented in an array, S being asked to sort them into groups and then to explicate the basis of the sorting. Under the request for new modes of sorting, this was repeated until S reached his limit. Finally, the cards were sorted by E, using principles of organization not previously used by S, and S was asked to explicate the basis of E's sorting.

The analyses of performance on both tasks were directed toward ascertaining ontogenetic changes in principles of organization utilized. The clustering technique was used to analyze the recall results: all pairs of words emitted contiguously by S on each trial were examined to determine the proportion of such pairs grouped according to particular principles of organization. The sorting behaviors were analyzed on the basis of the explications given for the groupings.

The results were as follows. Perceptual modes of organization were relatively little used in both tasks for all ages. This was attributed to both the character of the tasks and the age range of the Ss. These factors were viewed as fostering an orientation toward the words as sumbols rather than towards their stimulus characteristics.

The use of linguistic principles of organization was much more common. The use of syntactic organization in free recall and sementic organization in sorting increased with age. It was

suggested that the sequential presentation in the recall task favors serial modes of organization, such as syntactic order, while the simultaneous presentation in sorting favors categorial modes of organization, such as semantic classification. The findings indicate that older Ss were better able to make use of these modes of linguistic organization favored by the structure of the task.

Although the number of words recalled increased with age and trials, this increase was not correlated with clustering by either part of speech or syntactic order. Studies by others suggest that such a lack of relationship is attributable to the potency of idiosyncratic modes of organization which become dominant when associative ties among words are low in strength, as in the present study.

In sorting, the variety of distinct sorts performed--on both perceptual and linguistic bases--and the clarity of the verbal explications increased with age. These findings were viewed as aspects of the same developmental process: the increasing autonomy of the principles of organization from the materials in which they were originally embedded.

52. Clark, H.H., & Card, S.K. Role of semantics in remembering comparative sentences. *Journal of Experimental Psychology*, 1969, 82(3), 545-553.

It is proposed that comparative sentences are decomposed into independent semantic features for remembering. To test this proposal, 64 Ss were presented with eight types of comparative sentences and were later required to recall them. The sentences were either comparative (*is better than*) or equative (*is as good as*); they were either positive or negative; and they contained either unmarked adjectives (like *good*) or marked ones (like *bad*). In recalling presented sentences, Ss made systematic errors mostly predictable from semantic feature theory. The Ss tended to reconstruct unmarked from marked adjectives, affirmations from denials, and sentences meaning "strictly greater than" from sentences meaning "greater than or equal to." These preferences are each accounted for by the loss of one semantic feature in memory, not by the forgetting of the surface structure or syntactic features of a sentence.

53. Clark, H.H., & Clark, Eve V. Semantic distinctions and memory for complex sentences. *Quarterly Journal of Experimental Psychology*, 1968, 20, 129-138.

This investigation studied what people remember in recalling complex sentences, whether it is certain semantic distinctions or

merely transformational markers. After short intervals 24 subjects tried to recall sentences of six kinds which formed paraphrase sets: S_1 before S_2, S_1 and then S_2, After S_1 S_2, S_2 after S_1, S_2 but first S_1, and Before S_2 S_1. (S_1 and S_2 denote first and second clauses in temporal, not linguistic, order). Subjects remembered the underlying sense of sentences with S_1-S_2 clause ordering better than those with S_2-S_1 clause ordering, regardless of transformational complexity. Subjects also showed a response bias, hence better verbatim recall, for sentences with subordinate clause second and for sentences with S_1-S_2 clause ordering sentence confusions indicated that subjects remembered three semantic distinctions: the temporal order, order of mention, and main-subordinate relation of the two described events. A theory of memory for marked and unmarked semantic distinctions was used to account for the results.

54. Clark, H.H., & Stafford, R.A. Memory for semantic features in the verb. *Journal of Experimental Psychology*, 1969, 80(2), 326-334.

It was proposed that the verb is stored in long-term memory as a set of semantic features. Fifty-six Ss were asked to recall sentences which contained one of eight verb forms. The verbs were either past or present, either progressive or nonprogressive, and either perfect or nonperfect. In recall, verbs underwent semantic simplification. Perfect verbs were often recalled as nonperfect, and progressive as nonprogressive; however, present perfect verbs were often recalled as simple past, and present perfect progressive as past progressive. Each change intails the loss of one semantic feature, i.e., a simplification in the interpretation of the verb. The net result was a bias toward recalling past, nonperfect, and nonprogressive verbs. The errors in memory, it was argued, can be accounted for either by a theory of semantic memory or by a theory of syntactic memory with a basic reformulation of the verb's syntactic rules.

55. Cofer, C.N. A study of clustering in free recall based on synonyms. *Journal of General Psychology*, 1959, 60, 3-10.

Two 40-word lists were constructed, so that one was composed of eight groups of five synonyms each and the other, a control list, was composed of unrelated words. Randomized orders were prepared for each list. Six groups of subjects were used; one heard a single presentation of the synonym list, one two presentations in different orders of this list, and the third two presentations in the same order of this list. Control groups heard the control list in corresponding ways. There was an immediate retention test for all groups and a delayed retention test after two weeks. At the latter time, a second recall was given, which was accompanied by the presentation of cues, i.e., one word from each group in the list.

The results showed no differences between corresponding synonym and control groups in number of words recalled, but the synonym groups showed more clustering than the control groups. A second presentation of the list increased recall, especially in the first retention test, for all groups but affected clustering only in they synonym groups. The delayed cue trial produced more correct and previously unrecalled words in the synonym groups than in the control groups, but the difference was small and not considered an adequate indication of recovery of material previously forgotten.

It is tentatively concluded that the relation of synonymity may not be a very effective basis for cognitive organization.

56. Cofer, C.N. On some factors in the organizational characteristics on free recall. *American Psychologist*, 1965, 20, 261-272.

57. Cofer, C.N. Some evidence for coding processes derived from clustering in free recall. *Journal of Verbal Learning and Verbal Behavior*, 1966, 5, 188-192.

Clustering in free recall has often been interpreted as arising from use of the category name as a coding response. Data relevant to this interpretation are presented and interpreted with regard to three free-recall situations in which clustering is observed. It is concluded that category names do not play roles in clustering in the category-clustering situation or in the difference in clustering found for sets of words which comprise all the items of a category as compared with word sets which do not exhaust a category. However, there is evidence that the greater clustering found for categorized pair members than for noncategorized pair members with equal associative overlap may be due to the greater codability of the categorized pairs.

58. Cofer, C.N. Free recall of nouns after presentation in sentences. *Journal of Experimental Psychology*, 1968, 78(1), 145-152.

3 experiments compared item recall and category clustering in free recall of nouns presented in sentences and in various control conditions. Item recall was always poorer for nouns presented in sentences and category clustering was usually diminished by the sentence context. An interpretation which suggests that context may temporarily disrupt category membership or internoun associations seems consistent with the findings.

59. Cofer, C.N., & Bruce, D.R. Clustering of free recall as a function of certain methodological variations. *Journal of Experimental Psychology*, 1966, 71(6), 858-866.

3 experiments involving category clustering in lists composed of high-frequency (HF) and low-frequency (LF) associates of the category names are reported. (a) Block presentation augments clustering in both lists and augments word recall in HF but not in LF lists. (b) Word recall and clustering are higher in HF lists than in LF lists. (c) Duration of item-presentation interval augments both clustering and word recall within limits. (d) An immediate recall augments or maintains clustering and word recall on a second recall, obtained after a short delay. (e) It is concluded tht a coding hypothesis cannot do justice to all the findings. Associations between the category names and their instances or among the instances themselves are suggested as supplemental or alternative mechanisms.

60. Cohen, B.H. An investigation of recoding in free recall. *Journal of Experimental Psychology*, 1963, 65(4), 368-376. (a)

4 studies were conducted to evaluate G.A. Miller's chunk hypothesis. 70-word lists comprising 10 exhaustive and 10 non-exhaustive categories of words were presented for free recall. The results indicated that: (a) whether category recall was inferred from word recall or measured directly, between 10 to 14 categories were represented in recall; (b) significantly more words of exhaustive categories were recalled; (c) the 2 category types were used equally in recall; (d) there was a strong tendency to cluster related words in recall; and (e) an index of interitem associative strength, derived from word association norms, discriminated differences in recall between the 2 category types and was significantly related to within-category recall. The results were interpreted as providing support for Miller's position regarding recoding.

61. Cohen, B.H. Recall of categorized word lists. *Journal of Experimental Psychology*, 1963, 66(3), 227-234. (b)

According to Miller's chunk hypothesis, the number of word categories (chunks) represented in the immediate word recall of a list of 20 categories of words should be the same as the number of words recalled from a list of 20 unrelated words. Using a design involving list lengths of 10, 15, and 20 chunks and 3 types of word lists (2 categorized and 1 unrelated), the hypothesis was supported--but only if the lists were matched for total presentation time. An index of interitem associative strength, derived from word association norms, showed significant correlations with within-category word recall but was not related to chunk recall.

62. Cohen, B.H., & Bousfield, W.A. The effects of a dual-level stimulus-word list on the occurrence of clustering in recall. *Journal of General Psychology*, 1956, 55, 51-58.

A randomized dual-level stimulus-word list comprising 40 words with 10 each of *animals* (five *feline* and five *canine*), *countries* (five *South American* and five *European*), *names* (five *male* and five *female*), and *weapons* (five *shooting* and five *cutting*) was constructed and presented to 50 Ss for learning. The analyses of the clustering occurring during recall of this dual-level stimulus-word list were performed on two levels, a four-categroy level and an eight-category level. These results were compared with those of an earlier study where one list contained only four categories of words and another list contained only eight categories of words. The results support the following hypothesis: *The use of a dual-level stimulus-word list should result in stronger reinforcement of organizational systems than should be expected for comparable single-level stimulus-word lists.*

The findings are interpreted in terms of Hebb's account of the development of superordinate perceptions.

63. Cohen, G. A comparison of semantic, acoustic, and visual criteria for matching of word pairs. *Perception and Psychophysics*, 1968, 4(4), 203-204.

Ss judged the same pairs of words "same" or "different" under semantic, acoustic and visual criteria. RTs were compared for each criterion, and the effects of different kinds of confusability, such as acoustic similarity in the semantic matching task, or semantic similarity in the acoustic matching task, were also studied.

64. Cohen, J.C., & Musgrave, Barbara A. Effects of formal similarity on cue selection in verbal paired-associate learning. *Journal of Experimental Psychology*, 1966, 71(6), 829-838.

Sets of 6 nonsense syllables each having high formal similarity (H) or low formal similarity (L) were combined to form 6 2-element stimuli, where each compound stimulus consisted of 1 element from each set. Undergraduate women learned paired-associate lists with these compound stimuli as stimulus members and single letters as responses. In acquisition, lists composed entirely of L elements were learned most rapidly, lists composed 1/2 of H elements and 1/2 L elements were learned 2nd most rapidly, and lists composed entirely of H elements most slowly. In transfer, when the elements were taken out of the compounds and presented separately, there were more correct responses to elements from L sets than from H

sets; and to elements which had been in 1st rather than 2nd position in the acquisition compounds reading left to right.

65. Cole, R.A., Haber, R.N., & Sales, B.D. Mechanisms of aural encoding: I. Distinctive features for consonants. *Perception and Psychophysics*, 1968, 3(4B), 281-284.

To examine the importance of distinctive features that are used to encode consonants (following Wickelgren's analysis in an immediate recall task, sequences of 5 consonants, all paired with the vowel /a/ were constructed and presented aurally for recall. The middle three items in each sequence all had either the same place of articulation (front, middle, or back of the vocal apparatus), or the same manner of articulation (voiced, unvoiced, or nasal), or were unrelated in either place or manner (control). It was shown that, in comparison with the control sequences, consonants imbedded among others articulated similarly were recalled less accurately, suggesting that these distinctive features are important in encoding and memory maintenance. A comparison of the 3 manner and 3 place features showed that the greatest difficulty in recall occurred for the similar manner sequences (especially voiced and unvoiced), implicating manner of articulation as the critical distinctive feature in aural encoding. Some discussion is also presented of a distinction between articulation and acoustic factors in encoding processes.

66. Cole, R.A., Sales, B.D., & Haber, R.N. Mechanisms of aural encoding: II. The role of distinctive features in articulation and rehearsal. *Perception and Psychophysics*, 1969, 6(6A), 343-348.

Three experiments manipulated different aspects of hearing, encoding, rehearsal, and recall of short strings of consonants that differed in the number of similar distinctive features. Previous work had shown that sequences with similar manner-of-articulation features had more confusions than sequences with no internal similarities. With this finding as a baseline, the first experiment showed that requiring S to hold his mouth open during hearing or during hearing and rehearsal produced no changes in the pattern of errors. Thus, blocking gross articulation apparently had no effect on encoding, suggesting that gross articulatory movements are not necessary in short-term memory tasks. The second experiment prevented S from rehearsing the sounds by absorbing him in an irrelevant though noninterfering task. While overall performance was reduced, Ss were still able to remember some of the sounds even after 8 sec. However, sequences with similar manner-of-articulation features did not yield more confusions than control sequences, suggesting that distinctive feature comparisons are critical during rehearsal.

In the third experiment, the sounds were presented at a very fast rate, and had to be recalled immediately or after a 6-sec. delay. Even with the fast rate, confusions of relevant distinctive features occurred with the long delay. However, when recall was immediate, overall performance was better and not related to distinctive feature confusion, suggesting that recall might be based on an auditory image rather than the result of an encoded memory.

67. Collins, A.M., & Quillian, M.R. Retrieval time from semantic memory. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 240-247.

To ascertain the truth of a sentence such as "A canary can fly," people utilize long-term memory. Consider two possible organizations of this memory. First, people might store with each kind of bird that flies (e.g., canary) the fact that it can fly. Then they could retrieve this fact directly to decide the sentence is true. An alternative organization would be to store only the generalization that *birds* can fly, and to infer that "A canary can fly" from the stored information that a canary is a bird and birds can fly. The letter organization is much more economical in terms of storage space but should require longer retrieval times when such inferences are necessary. The results of a true-false reaction-time task was found to support the latter hypothesis about memory organization.

68. Collins, A.M., & Quillian, M.R. Facilitating retrieval from semantic memory: The effect of repeating part of an inference. *Acta Psychologica*, 1970, 33, 304-314.

In Collins and Quillian (1969) we found evidence that people decide whether simple sentences are true or false by using inferences. For instance, a sentence like "A canary can fly" apparently was confirmed by inference from the two facts that a canary is a bird and that birds can fly. If so, then this has a possible implication for reaction time (RT) to such sentences presented in succession. Prior exposure to one sentence should reduce RT to a second sentence whenever the same fact is involved in confirming both sentences. For example, prior exposure to "A canary is a bird" should reduce RT to "A canary can fly" more than to "A canary can sing," since we assume that no inference is used to confirm the latter sentence. In total eight RT difference predictions were made for various kinds of sentence pairs, and all eight of these predictions held. Two possible models could explain these results.

*69. Conrad, R. An association between memory errors and errors due to acoustic masking of speech. *Nature*, 1962, 193, 1314-1315.

Sequences containing 6 letters of the alphabet formed the material to be recalled.

The sequences were presented *visually*, one letter at a time, at a rate of 0.75 sec./letter with the chance of perceptual error known to be negligible. At the end of each sequence subjects immediately wrote down what they could recall of the letters in the order in which they occurred.

Although the sequences were presented to subjects visually, it is fairly obvious that the confusions which are made are similar to those likely to occur in the auditory perception of spoken letters in the presence of masking white noise.

A speech intelligibility study of the 10 test letters was carried out using two speakers and 50 listeners. Letters were spoken (1 every 5 sec) in the conventional way, and after each one subjects recorded what they thought it was. The level of masking noise varied from almost zero to 10 decibels above speech signal-level.

Clearly then there is an association between letters which confuse with each other when heard, and letters which confuse with each other in short-term memory.

*70. Conrad, R. Acoustic confusions and memory span for words. *Nature*, 1963, 197, 1029-1030.

In both experiments the test material consisted of 5-word sequences which, using a memory drum, were visually presented word by word at a rate of 1 word/sec. No word was repeated in one sequence. At the end of each sequence subjects wrote down what they could recall in the correct order.

Experiment 1. Each condition used 20 sequences. Condition (a): ten-word vocabulary composed of five pairs of visually different homophones. Condition (b): ten-word vocabulary composed of common acoustically dissimilar words. Performance was scored in terms of percentage of sequences correctly reproduced.

Experiment 2. Each condition used 40 sequences. Condition (b) used the same vocabulary as in (b) of the first experiment. In condition (c) every word in the entire test (200 words) was different, and all were common four-letter nouns or verbs drawn from the AA and A lists of Thorndike and Lorge. These results

provide far more support for a memory span model based on probability of acoustic confusion than for one based on information theory. I have shown that, if vocabulary size is constant, memory span is a function of probability of acoustic confusion. I have further shown that varying the vocabulary size may lead to either greater or smaller memory span. It seems *a priori* that the 200-word vocabulary of condition (c) has a smaller probability of acoustic confusion than the (a) vocabulary, and a greater one than the (b) vocabulary, and that these are the relationships on which the results depend.

71. Conrad, R. Acoustic confusions in immediate memory. *British Journal of Psychology*, 1964, 55(1), 75-84.

Sequences of 6 letters of the alphabet were visually presented for immediate recall to 387 subjects. Errors showed a systematic relationship to original stimuli. This is held to meet a requirement of the decay theory of immediate memory.

The same letter vocabulary was used in a test in which subjects were required to identify the letters spoken against a white noise background. A highly significant correlation was found between letters which confused in the listening test, and letters which confused in recall.

The role of neurological noise in recall is discussed in relation to these results. It is further argued that information theory is inadequate to explain the memory span, since the nature of the stimulus set, which can be defined quantitatively, as well as the information per item, is likely to be a determining factor.

72. Conrad, R. Interference or decay over short retention intervals? *Journal of Verbal Learning and Verbal Behavior*, 1967, 6, 49-54.

It is well established that if a formally noninterfering task which minimizes rehearsal is interposed between presentation and recall of a short consonant sequence, recall lessens as retention interval is increased. Superficially, this appears to be a classical example of decay. Keppel and Underwood have proposed an alternative explanation in interference-theory terms suggesting that forgetting in this paradigm is due to proactive interference from extinguished associations from prior trials which recover during the retention interval.

An experiment was carried out which varied retention interval after four consonants had been presented. More forgetting occurred as a result of the longer interval, but the main dependent variable was the nature of "intrusions." For neither the short

nor long interval were wrong letters equiprobable, errors tending to be acoustically similar to the correct letter. But the distribution of long-interval errors tended more towards random than did that for the short interval. It is argued that the difference in error distribution between short and long interval is incompatible with the Keppel and Underwood explanation. A modification of decay theory is proposed which regards decay as a loss of discriminative characteristics (in the present case acoustic), and recall as a process involving discrimination of available traces. This model would be supported by the error-distribution data.

73. Conrad, R. Short-term memory processes in the deaf. *British Journal of Psychology*, 1970, 61, 179-195.

Two experiments are reported. In the first, profoundly deaf schoolboys read consonant sequences for immediate written recall, reading, according to instruction, either silently or aloud. Detailed error analysis suggested a dichotomous classification of subjects into those primarily relying on articulatory coding (A group) and those relying on some other mediating code which could depend on shape (non-A group). This classification correlated significantly with teachers' ratings of speech quality.

The A group showed no effect of reading mode on total number of errors. But the non-A group were significantly worse when reading aloud. Errors were distributed across serial positions effectively identically, regardless both of coding behaviour and reading mode. A recency effect was found of an order somewhere between that for hearing subjects reading this kind of material silently and reading it aloud.

A test of the reliability of the classification into A group and non-A group was made in the second experiment. In this the same subjects silently read word lists for immediate written recall. Lists were drawn from one of two vocabularies: one consisting of five pairs of common homophones, the other of five pairs of common words assumed to look similar. The A group recalled significantly more words of the latter lists, while the non-A group recalled both lists equally well.

The results are discussed in relation to current models for short-term memory and to their implications for the education of the deaf. In the former connexion, the presence of recency with subjects who have no auditory feedback would be an embarrassment to 'echo-box' type accounts of recall. With respect to the latter, two main points are made: (1) deaf school children do not all memorize in the same code, and for some it may be different from that used by teachers. (2) if memorizing names of things is impaired by reciting them aloud, a hitherto concealed weakness of a common instructional procedure is exposed.

74. Conrad, R., Baddeley, A.D., & Hull, A.J. Rate of presentation and the acoustic similarity effecting short-term memory. *Psychonomic Science*, 1966, 5(6), 233-234.

Ss attempted to recall sequences of six consonants drawn from either an acoustically similar set (B C D G P Q T V), or from a relatively dissimilar set (H K M P R S W Y). Letters were presented visually at a rate of 60 or 120 letters per min. Performance was impaired by acoustic similarity ($p < .001$) but there was no effect of rate of presentation and no interaction between rate and similarity. This does not support a limited channel capacity interpretation of the acoustic similarity effect.

75. Conrad, R., Freeman, P.R., & Hull, A.J. Acoustic factors versus language factors in short-term memory. *Psychonomic Science*, 1965, 3, 57-58.

Forty-five Ss recalled 6-consonant sequences immediately after letter by letter visual presentation. The main factor contributing to ease of recall was within-sequence acoustic confusability. Language habits were relatively unimportant. Single-letter language frequency was unrelated to recall; second order effects made a small but significant contribution.

76. Conrad, R., & Hull, A.J. Information, acoustic confusion and memory span. *British Journal of Psychology*, 1964, 55(4), 429-432.

Immediately after visual presentation, subjects were required to recall 6-letter sequences. Sequences were drawn from four vocabularies. There were two 3-letter vocabularies, distinguished by the probability of acoustic confusion within them, and two 9-letter vocabularies similarly distinguished. Memory span is shown to be effectively independent of information per item, and to depend substantially on the probability of acoustic confusion within vocabularies.

77. Conrad, R., & Rush, Mary Lou. On the nature of short-term memory encoding by the deaf. *Journal of Speech and Hearing Disorders*, 1965, 30(4), 336-343.

A pilot attempt was made to examine the kind of imagery used by severely deaf children in short-term memory storage of visually presented consonant sequences. The rationale of the approach was that systematic recall errors could be taken as indicative of the types of sensory coding used by subjects to hold the material in store.

Subjects, both deaf and hearing controls, read briefly exposed five-consonant sequences and, at the end of each exposure, wrote

down what they could recall. Error matrices for the two groups were examined.

Hearing subjects made a number of systematic recall errors which could be shown to be acoustically similar to the correct letters. Deaf subjects also made certain systematic errors. These were not acoustically related to correct letters; nor insofar as the data permitted reliable test could they be regarded as spatially related. The consistency of errors made by the deaf implies a consistent encoding procedure which is at present obscure. There seems, though, to be no basic methodological reason why the nature of the memory code or codes used by the deaf should not, with improved experimental procedures, be revealed.

78. Cook, T.H., Mefferd, R.B., Jr., & Wieland, Betty A. Effects of idiodynamic set and stimulus characteristics on numeral homonym associates. *Psychological Reports*, 1965, 17, 583-589.

Three groups of 60 and one group of 100 Ss associated to word lists which varied in the order of occurrence of 4 numeral homonyms (e.g., *eight-ate*), in the position of an unambiguous numeral (*viz., three*) in the stimulus list, and in the number of intervening non-numeral stimulus words. Numeral responses were facilitated in a non-specific manner by the unambiguous numeral and by a decreased interval between the numeral stimulus words. Individual differences in a contrast-logical coordinate idiodynamic set were significantly related to the numeral response tendency. It was concluded that word association responses are determined by the interaction between transient stimulus effects and enduring characteristics of individual Ss.

79. Corman, C.D., & Wickens, D.D. Retroactive inhibition in short-term memory. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 16-19.

Forty-eight Ss were exposed to three types of constructions of STM items. In two of the constructions, material of the same class as the to-be-remembered item were included in the material S recited during the retention interval. The interpolated similar material either occurred near the beginning or near the end of the retention interval. A significant decrement in retention was found with the inclusion of the similar material, but no significant relationship was found between the amount of retention and the temporal position of the interpolated material within the retention interval. These results were interpreted as being consistent with an interference theory of forgetting.

80. Cowan, T.M. The semantic differential as a basis for obtaining clustering. *Dissertation Abstracts*, 1965, 25, 4824-4825.

The study was designed to test the hypothesis that the semantic differential ratings could be used as a basis for obtaining clustering in recall. Previous investigations have indicated that words having a common component of connotative meaning constitute a distinct response class in operant conditioning. This suggests that perhaps words having a single component of meaning in common would tend to occur together in recall. Four lists were constructed, each with ten words and each strongly representing a single component of connotative meaning. The four components of meaning were GOOD, BAD, CURVED, and STRAIGHT. Ten words with low intensity ratings on each of these four components, comprised a fifth NULL word list. Each high intensity list was separately combined with every other list and the NULL words to form six lists of thirty words. Each of the six lists represented a separate experimental condition, and six independent groups of Ss were randomly assigned to these six conditions. The words were presented visually to the Ss three times in three different random orders. The Ss were then asked for a free recall of the projected words. The number of sequential repetitions of words in a given category occurring in recall comprised the measure of clustering. Differences in clustering were expected between each high intensity category and NULL category. However, only one high intensity category (STRAIGHT) showed significantly greater clustering than the NULL words. Thus the hypothesis was only partially confirmed. Further tests were made to see if the clustering of words varied by condition. That is, the effect of the presence of different categories on clustering in a particular word group was assessed. It was shown that CURVED words clustered more in the presence of STRAIGHT words than in the presence of GOOD words. These results were not predictable on the basis of the semantic differential rationale. The application of associationistic interpretations to the results were discussed.

81. Craik, F.I.M. Two components in free recall. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 996-1004. (a)

It is now widely believed that in the short-term retention of verbal material, both primary memory (PM) and secondary memory (SM) mechanisms are involved. In the experiments reported here an attempt was made to separate the PM and SM components in immediate free recall. The first experiment showed that neither age nor the size of set from which words were drawn affected the size of the PM component but that both factors affected retrieval from SM. The second experiment showed that word length affected neither the PM nor the SM component. It was concluded that PM stores a constant number of words regardless of word length.

82. Craik, F.I.M. Types of error in free recall. *Psychonomic Science*, 1968, 10(10), 353-354. (b)

If the free recall of unrelated word lists depends on one memory store, then although the absolute number of errors may change as recall proceeds there is no reason for the relative proportions of different types of error to change. On the other hand, if recall consists of output from a short-term store which employs acoustic coding, followed by retrieval from a long-term store with different characteristics, a change in the proportions of errors would be expected. The results support the latter proposition.

83. Craik, F.I.M. Modality effects in short-term storage. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 658-664.

Recent studies have shown that auditory presentation is superior to visual presentation for the short-term retention of verbal material. The experiments reported here used a modified free-recall method in which Ss started their recall with items from either the beginning or the end of the list. It was found that auditory presentation gave rise to a larger recency effect than visual presentation and that this discrepancy was increased when recall started at the beginning. The suggested interpretation is that after recalling the items in a "post-recognition" short-term store, Ss can also retrieve ralatively unprocessed information from "pre-recognition" stores and that this information persists for a longer time with auditory as compared to visual input.

84. Cramer, Phebe. Mediated priming of polysemous stimuli. *Journal of Experimental Psychology*, 1968, 78(1), 137-144.

This study investigated the relationship of mediated priming of associative responses to commonness of response meaning, stimulus familiarity, and response familiarity. The results indicated that such priming can be used successfully to increase the frequency of responses representing alternate meanings of homographic stimuli. The priming effect was found to be inversly related to commonness of response meaning, but directly related to response familiarity. Several interaction effects were noted. A supplementary study suggested that priming may be a highly specific effect, focused on one particular word rather than on a domain of semantically related responses.

85. Cramer, Phebe. Functioning of implicit associative responses in mediated transfer. *Journal of Experimental Psychology*, 1969, 82(2), 301-309.

Using an A'-B, A-C paradigm, a 3 x 3 x 2 factorial experiment was designed that varied the strength of implicit associative

responses (IARs), the degree of first-list learning, and the locus of mediation. The results from 18 independent groups of Ss (N = 16/group) indicated that transfer was a function of the interaction of these three variables. With increasing degrees of original learning, transfer became positive for the unidirectional paradigms, but remained negative for bidirectional paradigms. The results are interpreted as supporting three hypotheses: (a) Presentation of a stimulus word results in the automatic elicitation of IAR of differing strengths in the associative hierarchy, any one of which may function to mediate transfer; (b) in a transfer task, such IAR elecitation occurs both during original list (OL) and test list (TL) learning; (c) under certain conditions, if the elicitation of such IARs produces interference, S is able to inhibit their occurrence.

86. Cramer, Phebe. Semantic generalization: Demonstration of an associative gradient. *Journal of Experimental Psychology*, 1970, 84(1), 164-172. (a)

Three studies are reported which investigated the relationship between verbal associative strength and semantic generalization, as measured by the occurrence of overt and implicit motor responses. Using an instrumental conditioning paradigm, generalization stimuli (GSs) were selected to represent four points of decreasing associative strength for 24 different associative hierarchies. The results consistently show generalization to be a linear function of the position and associative strength of the GSs in the associative hierarchy.

87. Cramer, Phebe. Semantic generalization: IAR locus and instructions. *Journal of Experimental Psychology*, 1970, 83(2), 266-273. (b)

The role of implicit associative responses (IARs) that occur during training and during testing was investigated in three studies of semantic generalization. The results indicate that both training-stage and test-stage IARs contribute to the generalization effect. Moreover, greater generalization was found under conditions of incidental learning than when S was given instructions for intentional learning.

88. Crouse, J.H. Verbal discrimination transfer in two paradigms as a function of conceptual similarity and anticipation interval. *Journal of Verbal Learning and Verbal Behavior*, 1967, 6, 277-281.

In the acquisition of a first verbal discrimination list, the variable manipulated was conceptual similarity, high or low, among both the correct and the incorrect words within the list. Upon

transfer to a second verbal discrimination list, the variables were transfer paradigm, conceptual similarity for the words within the second list and anticipation interval (longer or shorter than on List 1). In the Type 1 paradigm correct words in List 1 appeared as incorrect words in List 2. In the Type 2 paradigm correct words in List 1 were replaced by conceptually similar words, which were incorrect, in List 2. In the Control paradigm all words in List 1 were unrelated to the words in List 2. Conceptual similarity did not affect List-1 learning. On List 2 both the Type 1 and Type 2 paradigms produced positive transfer, compared to the Control, on early trials. Transfer in the Type 1 paradigm was unaffected by conceptual similarity, but in the Type 2 paradigm high similarity resulted in more transfer than low similarity. The longer anticipation interval produced better performance in all groups but did not differentially influence transfer in any paradigm. In later transfer the Type 1 but not the Type 2 paradigm resulted in positive transfer.

89. Crouse, J.H. Storage and retrieval of words in free-recall learning. *Journal of Educational Psychology*, 1968, 59(6), 449-451.

2 free-recall learning experiments were performed. In Experiment I the presence or absence of retrieval cues was varied factorially with the presence or absence of storage cues. Retrieval cues facilitated recall when storage cues were present, but not when they were absent. Experiment II showed that the facilitating effects of retrieval cues depended on the pairing of storage cues and the words to be recalled. The results were interpreted in terms of the storage tags generated during input.

90. Crowder, R.G. Intraserial repetition effects in immediate memory. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 446-451. (a)

Seventy-five Ss recalled series of consonants containing all possible locations of a single repeated element (RE) across 8 serial positions. When the two occurrences of the RE were adjacent or separated by one intervening nonrepeated element (NRE) there was facilitation both of overall recall and of recall for the positions of the RE. When occurrences of the RE were separated by two or more intervening NRE's, there was inhibition of recall at the locations of the RE. The possible roles of input and output processes in intraserial repetition effects were discussed.

91. Crowder, R.G. Repetition effects in immediate memory when there are no repeated elements in the stimuli. *Journal of Experimental Psychology*, 1968, 78(4), 605-609. (b)

2 experiments are reported in which Ss recalled series of 8 consonants immediately following auditory presentation. S was required always to include 1 prearranged, redundant consonant in his recall, as a prefix before the series in Exp. I and between the 2nd and 3rd elements in Exp. II. In both studies there was a comparison of inclusive conditions, where the redundant letter also occurred as part of the memory series, with exclusive conditions, where the redundant element was never repeated in the memory series. The main finding was that patterns of output repetition in the inclusive conditions affected the form of the serial position curve, simulating, in critical cases, the effects of intraserial repetition (a repeated letter in the series as presented). These results were interpreted as evidence that the effects of distributed intraserial repetition are attributable chiefly to output rather than input processes.

92. Crowder, R.G. Phonic interference and the prefix effect. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 302-304.

Forty-two Ss recalled 90 series of 8 consonant letters, 30 under control conditions and 60 under each of two prefix conditions. The prefix letter was either V or K. In each 8-letter series half of the letters were phonically similar to V (from the subset BDGTPZ) and half were not (from the subset HJLNRX). An account of the prefix effect based on retroactive inhibition predicts that (a) V as prefix should disrupt recall more than K, and (b) the difference between prefix effects of V and K should be larger in performance on the BDGTPZ subset than on the JHLNRX subset. Both predictions were supported by the results.

93. Crowder, R.G., & Melton, A.W. The Ranschburg phenomenon: Failures of immediate recall correlated with repetition of elements within a stimulus. *Psychonomic Science*, 1965, 2, 295-296.

Seven-consonant stimuli were recalled immediately. When the consonant in Position 2 was repeated in Position 5, 6, or 7, an increase in errors occurred at the latter position, as compared with control stimuli involving no repetition. Confirmation of the Ranschburg Phenomenon does not occur, however, when the repeated-element positions are 2 and 4. Nor was there an increased error rate for elements following a repeated element. These observations support the importance of intra-stimulus interference in immediate memory, but leave uncertain the associative mechanism responsible for such interference.

94. Crowder, R.G., & Morton, J. Precategorical acoustic storage (PAS). *Perception and Psychophysics*, 1969, 5(6), 365-373.

A system for precategorical storage of acoustic information is described. Material in this store is subject to overwriting and to decay with time. Precategorical Asoustic Storage (PAS) receives information only from the ears; it is not affected by silent rehearsal or by visual stimulation, and is explicitly distinguished from storage in terms of articulation. Two experiments are reported in which these properties of PAS are tested. Postulation of PAS permits an account of serial position functions for visual and auditory presentation in immediate memory, a distinction between "recency" and "finality" effects, the differential effects of a redundant prefix and a redundant suffix, effects of vocalization at presentation and at recall, and the relation between memory confusions and speech perception. Implications for a general theory of human memory are discussed.

95. Dainoff, M., & Haber, R.N. Effect of acoustic confusability on levels of information processing. *Canadian Journal of Psychology*, 1970, 24(2), 98-108.

A modification of Posner and Mitchell's (1967) choice reaction-time design was employed in which Ss were required to respond "same" or "different" to simultaneous pairs of letters. Response was always on the basis of name identity (e.g., AA and Aa are "same," AB is "different"). Letter pairs were selected from populations of acoustically confusable or non-confuable letters. Each pair of letters was either physically identical, had identical names, or had different names. The reaction times to physically identical pairs were fastest, and did not differ between confusable and non-confusable pairs. For all other comparisons, reaction time to acoustically confusable pairs took longer than to non-confusable pairs. The results are seen as supporting the hypothesis of an auditory encoding stage at which compairsons between items are made on the basis of acoustic components of their memory representations.

96. Dale, H.C.A. Semantic similarity and the A-B, C-D paradigm in STM. *Psychonomic Science*, 1967, 9(2), 79-80.

Although RI is influenced by the semantic similarity of stimuli with the A-B, C-D paradigm in normal P-A learning, comparable effects have not been found in STM. Earlier work was open to the criticism that the normal RI procedure was not paralleled by the STM conditions. The present experiments rectify this deficiency, but the effects of stimulus similarity are still absent.

97. Dale, H.C.A., & Baddeley, A.D. Acoustic similarity in long-term paired-associate learning. *Psychonomic Science*, 1969, 16(4), 209-211.

Baddeley and Dale (1966) using a classical A-B, A'-C interference paradigm showed an adverse effect of semantic similarity on the long-term retention of paired associates. The present study applied the same procedure to the study of acoustic similarity. No significant effect was found.

98. Dale, H.C.A., & Gregory, M. Evidence of semantic coding in short-term memory. *Psychonomic Science*, 1966, 5(2), 75-76.

An effect of semantic similarity in short-term memory was demonstrated and was compared with the effect of acoustic similarity. In free recall, using the RI paradigm, semantic similarity between OL and IL increased intrusions from IL, but decreased omissions. By contrast, acoustic similarity caused both IL - instrusions and omissions to increase.

99. Dale, H.C.A., & McGlaughlin, A. Acoustic similarity in RI and PAL. *Psychonomic Science*, 1968, 13(4), 225-226.

With the A-B, C-D paradigm it is shown that for both STM and LTM first list retention is unaffected by the degree of acoustic similarity between the stimuli of the IL and OL lists when numbers are used as responses.

100. Dallett, K.M. The transfer surface re-examined. *Journal of Verbal Learning and Verbal Behavior*, 1962, 1, 91-94.

In an experiment designed to generate a surface, similar to the Osgood surface, relating interlist stimulus and response similarity to proactive inhibition, three degrees of interlist response similarity and four degrees of interlist stimulus similarity were combined factorially in a PI design. Subjects learned two successive lists, and were tested after 20 min. for retention of the second list. Variations in interlist similarity were brought about by using different first lists, the second list being the same for all groups. There were no significant differences in recall. When List-2 learning scores were adjusted by a covariance analysis for differences in degree of List-1 learning, the results conformed quite well to the predictions of the Osgood transfer and retroaction surface.

101. Dallett, K.M. Number of categories and category information in free recall. *Journal of Experimental Psychology*, 1964, 68(1), 1-13.

5 experiments were carried out to investigate the effect of number of categories (NC) on the free recall of category lists. In Experiment I it was found that recall was a curvilinear function of NC in 12-word lists when all members of a given category were contiguous in presentation. Lists of 1, 2, 3, 4, or 6 categories were used, with the best performance occurring in the 4-category condition. The 2nd experiment resulted in similar findings for 12-word randomized lists; again, the relation between NC and recall was curvilinear, with the best performance occurring in the 2-category condition. In a 3rd experiment, the 2-, 4-, and 6-category conditions of Experiments I and II were repeated and each S was given a list of the categories which he was allowed to keep before him during presentation and recall. This extra information improved performance in the 6-category condition, but not in the 2- or 4-category conditions. Experiments IV and V used 24-word lists, and yielded decreasing recall as a function of NC. Degree of category clustering did not always parallel recall scores.

102. Dallett, K.M. Effects of within-list and between-list acoustic similarity on the learning and retention of paried associates. *Journal of Experimental Psychology*, 1966, 72(5), 667-677.

Using homophones as stimuli and similar-sounding words (e.g., CANVAS-CAMPUS) as responses, 4 experiments were carried out to compare the learning and retention of lists of high intralist similarity (W), high interlist similarity (B), and lists of low similarity (Control). Experiment I was used to select degrees of learning for Experiments II and III. In Experiment II, List 2 recall after 1 wk. indicated superior retention of W. In Experiment III, free recall of both lists after 1 wk. indicated superior recall for W, and, to a lesser extent, for B. Experiment IV compared recall for a single list (W vs. Control), with W better retained after 1 wk. In all experiments, W markedly retarded learning with B impeding List 2 learning slightly. All of the W and B conditions were run with both consistent and inconsistent pairings: in a consistent pairing, if BORE was paired with CANVAS, then BOAR would be paired with CAMPUS. The inconsistent pairings were generally deleterious to learning, but did not affect retention much.

103. Dalrymple-Alford, E.C. Interlingual interference in a color-naming task. *Psychonomic Science*, 1968, 10(6), 215-216.

When bilinguals, presented with lists of words written in different colors, name the colors as quickly as possible, inter

ference with color naming has been found to depend on the semantic similarity between the words and the correct response, whether these come from the same or from different languages. However, in the present study, when the interference word was the translation of the correct response interference was greatly reduced, a result not attributable to overt translation. An explanation in terms of a 'priming' effect is suggested.

104. Dalrymple-Alford, E.C., & Aamiry, A. Language and category clustering in bilingual free recall. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 762-768.

Arabic-English bilinguals were given free recall learning trials with a list of words drawn from two taxonomic categories, half the words in each category in English and half in Arabic. Lists which were serially organized into language blocks tended to be less well recalled than lists organized into category blocks. Analysis of clustering suggested that the main principle of subjective organization was in terms of intralingual/intra-category groupings. A second experiment using English-Arabic-French lists also supported this conclusion. The results were interpreted as reflecting greater intralingual/intracategory associative strength than either intralingual/intercategory or interlingual/intracategory associative strengths.

105. Danks, J.H. Grammaticalness and meaningfulness in the comprehension of sentences. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 687-696.

Comprehension of deviant sentences was studied in two experiments. The within sentence variables investigated were grammaticalness (G), meaningfulness (M), word frequency (F), interword association (A), and syntactic frame (SF). In Experiment I, a principal components analysis of ratings of sentence comprehensibility yielded factors interpretable as ungrammaticalness, nonmeaningfulness, and comprehensibility. In Experiment II, the latencies for Ss to understand the sentences were primarily a function of M and, to a lesser extent, G. The time needed to correct the grammar of the sentences was a function of both G and M, and the time to correct the meaning was a function of M. In both experiments, the effects of F, A, and Sf were either small or insignificant.

106. Davis, G.A. Recognition memory for visually presented homophones. *Psychological Reports*, 1967, 20, 227-233.

Underwood's (1965) finding that undergraduate Ss would mistakenly recognize words (e.g., HARD) which had not actually

occurred earlier in a 200-word list but which were strong verbal associates of words (e.g., SOFT) which had, in fact, occurred earlier in the list, was replicated. Also, using the same recognition memory task, when members of a homophone pair had different meanings (e.g., STEAK vs STAKE), false recognition frequencies were low. When members of the homophone pair elicited the same meaning (e.g., 12 vs TWELVE), false recognition rates were high.

107. DeBurger, R.A., & Donahoe, J.W. Relationship between the meanings of verbal stimuli and their associative responses. *Journal of Verbal Learning and Verbal Behavior*, 1965, 4, 25-31.

This study investigated the relationship between verbal stimuli and successive associative responses using both a measure of meaning (the semantic differential) and an index of association strength. Two methods of response production were employed: repeated association. The meaning of the response became progressively less similar to the stimulus with succeeding associates, the effect being more pronounced with chain association. The indes of association strength indicated that the later associates were less strongly linked to the stimulus, the effect again being more pronounced with chain association. Thus, changes in meaning and associative strength were similarly affected by the association method, this covariation being maintained throuyhout the association process.

108. Deese, J. Influence of inter-item associative strength upon immediate free recall. *Psychological Reports*, 1959, 5, 305-312. (a)

Lists consisting of 15 words each were presented to Ss for immediate free recall. For each of the 18 lists a measure of inter-item associative strength was obtained; this consisted of the average relative frequency with which all items in a list tend to elicit all other items on the list as free associates. Inter-item associative strength was positively correlated (.88) with the number of words recalled per list, negatively correlated (--.48) with the number of extra-list intrusions in recall, and positively correlated (.55) with the commonality of the extra-list intrusions that did occur. In general, these results are consistent with an interpretation of free recall in terms of free association. Free association, as it occurs in recall, is probably a direct, unmediated activity with little or no active editing of the material being recalled. The data on intrusions from the present experiment are consistent with the assumption of lack of editing. The fact that Ss in the present experiment gave no evidence of using an extra-list associative mnemonic device made available to them suggests that the free association from item to item in recall is not the result of Ss' instructing themselves to free associate in order to increase recall.

109. Deese, J. On the prediction of occurrence of particular verbal intrusions in immediate recall. *Journal of Experimental Psychology*, 1959, 58(1), 17-22. (b)

Lists consisting of 12 words each were presented to 50 Ss for a test of immediate recall. In the recall of these lists, particular words occurred as intrusions which varied in frequency from 0% for one list to 44% for another. Data gathered on word-association frequencies clearly showed that the probability of a particular word occurring in recall as an intrusion was determined by the average frequency with which that word occurs as an association to words on the list. The correlation between probability of intrusion and mean association value was .873. The regression, over the range examined, was linear, and this suggests the hypothesis that the probability of occurrence of a particular word as an intrusion in recall is proportional to the average association strength of that word to the words on the list.

110. Deese, J. Frequency of usage and number of words in free recall: The role of association. *Psychological Reports*, 1960, 7, 337-344.

The present experiment reports data on number of words correctly recalled after one presentation of lists varying in (a) frequency of usage of the words in the lists and (b) number of words presented for recall in any given list. The mean number of words recalled increases both with frequency of usage and list length; there is also an interaction between frequency and list length such that recall for high frequency long lists is desporportionately higher than for low frequency long lists. The words used in the present experiment were chosen at random, with only the restrictions of frequency of usage and list length. Nevertheless, it was discovered that certain of the lists contained words associatively related to one another. An index of the average tendency for all words in each list to be elicited as associates by all other words in that list was computed. This index of inter-word association was larger with randomly selected high frequency lists than with low frequency lists and with longer than with snorter lists. Evidence was produced which tended to support the hypotheses that variation in free recall scores with frequency was largely the result of differences between frequencies in inter-word associations, and that the interaction between list length and frequency on free recall was likewise largely the effect of inter-word association.

111. Deno, S.L., & Jenkins, J.J. Semantic generalization of a voluntary response: Effects of responding in training and rate of presentation. *Journal of Verbal Learning and Verbal Behavior*, 1967, 6, 300-302.

This study was designed to determine whether the motor response made during the learning stage of the semantic-generalization

experiment affects the amount of generalization obtained in the test stage, and to investigate the effect of word-presentation rate on the extent of generalization in such an experiment. Two response conditions during learning (lever press or no lever press) and two rates of word presentation (1.5 sec and 2.2 sec) were combined in a factorial arrangement of treatments. Semantic generalization was reliably obtained in all four experimental groups. Further analyses of the results indicated that presentation time had a significant effect on the amount of generalization (the fast rate yields more generalization), but response condition during learning did not.

112. Dong, T.T.L. Organization in memory: Storage and retrieval of categorized words. *Dissertation Abstracts*, 1969, 29(12B), 4863.

The retrieval phase of the human memory process was studied using a method of sampling for recall of portions of a stimulus input list. The conditions under which retrieval cues are effective were also delineated in the experiments.

Retrieval of memory information was investigated in a series of eight experiments using three basic experimental conditions. All subjects (Ss) were given a stimulus list consisting of word categories which had equal number of words per category. During recall, the cued recall condition (CR) was required to recall as many words from the input list as they could; they had the category names on their recall sheets as recall cues. A NCR (no cues in recall) condition recalled from the entire input list also, but they were not provided with recall cues. The final experimental condition consisted of Ss who were told to expect to recall from the entire input list; but at recall, they were required to recall only from a single randomly chosen word category of the input list; this was the cued partial recall (CPR) condition. Three dependent measures were compared among the three recall conditions. They were total words recalled, number of categories represented by the words recalled, and mean number of words per category recalled (MW/CR).

A series of eight experiments was performed to investigate retrieval of memory information. These experiments resulted in two major conclusions. First, the partial cuing aspect of the experiments revealed that Ss who recalled from a single randomly chosen category had better MW/CR than whole-list recall groups. The recalling of a word category first and only in CPR was responsible for the CPR superiority. The avoidance or elimination of output interference during retrieval was suggested as the reason for the CPR effect.

The second major conclusion concerned the effectiveness of retrieval cues. An attempt was made to discover the conditions

which were necessary for the effectiveness of retrieval cues. The outcomes of the experiments showed that cuing at input or blocking of words by categories was necessary for recall cues to facilitate memory performance. It was postulated that the input cuing and category blocking manipulations controlled the methods of word organization used by Ss such that a correspondence between the subject's organization and the experimenter's intended organization was achieved.

113. Dong, T.T.L., & Kintsch, W. Subjective retrieval cues in free recall. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 813-816.

The Ss sorted unrelated words into categories using whatever principles occurred to them. They were asked to provide labels for the categories. Finally, some Ss were asked to recall the words with their subjective category labels as cues, while others were not given cues in recall. The cues facilitated recall.

114. Drew, C.J., & Logan, D.R. Extra-list errors in paired associate learning by retarded and normal children. *Psychological Reports*, 1970, 26, 467-471.

This study compared the proportions of extra-list intrusions in errors by retarded and normal Ss on a paired-associate task. Associative strength of the paired items was varied. Results indicated that retardates imported a significantly greater proportion of responses than normals under both levels of associative strength. Ss did not import differential proportions of responses as a function of associative strength.

115. Duke, Ann W. Short-term retention of a single item as a function of acoustic similarity to interfering items. *Dissertation Abstracts*, 1968, 28, 3488.

The present study was designed to investigate the short-term retention of a single recall syllable which was embedded in a list of six such syllables as a function of (a) the acoustic similarity of the recall syllable to other items in the list and (b) the locus of the acoustic similarity. The major question under investigation was whether variation in the presence and locus of acoustic similarity affects retention of verbal items. A subsidiary question of interest was whether the retention of word and nonword items was differentially affected by this type of similarity.

The materials consisted of single verbal items which were embedded in lists of other verbal items. All verbal items

corresponded phonemically to CVC syllables. One-half of the verbal items were words and one-half were nonwords. The six items in the embedding list had either a constant phonemic beginning with each item in the list containing the same initial and middle phonemes or a constant phonemic ending with each item having the same middle and final phonemes. The embedded recall item was defined as similar to the list items if it had the same initial and middle phonemes or if it had the same middle and final phonemes as the items in the list. The recall item was defined as dissimilar if it did not have phonemes in common with the constant phonemic portion of the list items.

Each of 96 fourth grade children was visually presented 32 lists of items. In every list, the items were individually presented for 3 sec. with the presentation of the embedded recall item preceded by a 3 sec. presentation of three asterisks. Following list presentation, the visual presentation of three asterisks signalled the onset of a 9 sec. recall interval.

There were eight classes of embedded recall items resulting from the combination of the following three factors: (a) the similarity relationship between the recall and list items [similar (S) or dissimilar (D)]; (b) the locus of phonemic constancy [initial plus middle (CB) or middle plus final (CE)]; and (c) the type of recall item [word (W) or nonword (N)]. Predictions concerning the retention of these items were made on the basis of Wickelgren's (1965c, 1966) theory.

The dependent variable of interest was the total number of correct responses over the 32 presentation. An analysis of variance and a series of t-comparisons were performed on this measure. The major findings were (a) words were retained better than nonwords and (b) items (except dissimilar items which were words) embedded in lists with initial constancy were retained more poorly than items embedded in lists with final constancy. There was no significant effect for the similarity-dissimilarity manipulation in the analysis of variance and only one t-comparison (S-CB-W vs. D-CB-W) involving this factor was significant with better retention of D-CB-W items than of S-CB-W items.

Wickelgren's (1965c, 1966) theory was only partically confirmed. The most damaging result to his theoretical formulation was the absence of a similarity-dissimilarity effect. Thus, one might conclude that similarity-dissimilarity, as it was manipulated in this study, does not affect retention. However, an alternative interpretation was suggested which involved the operation of different sources of interference for similar and dissimilar items. It was suggested that, perhaps, in the present study, these different sources of interference had similar effects on retention and, thus, there was no apparent similarity-dissimilarity

effect. Some tentative support for this alternative interpretation was provided by an examination of the types of errors and sequential probabilities for the eight classes or recall items. It was concluded, however, that further research was needed to determine whether the similarity-dissimilarity manipulation employed in this study does or does not affect retention.

116. Dunn-Rankin, P. The similarity of lower-case letters of the English alphabet. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 990-995.

A study was made of the similarity between lower-case letters of the English alphabet by means of a relative discrimination task. Scales of letter similarity were produced which indicate the relative position of such letters to the target letters. Analysis of the scales reveals clearly definiable clusters of letters. Implications for discrimination training, for diagnosis of reading readiness, and for studies of the critical features of letters are discussed.

117. Eagle, M.N. The effect of learning strategies upon free recall. *American Journal of Psychology*, 1967, 80, 421-425.

Two studies were carried out on the relationship between learning strategies and recall. In the first study, Ss who reported using an associative organization, i.e., strategy--linking words in some manner--recalled significantly more words than Ss reporting straight rehearsal. In the second study, strategies were assigned via instructions to different groups. Strategy instructions per se had no direct effect on recall, but reported stragegy significantly influenced amount of recall. In all three instruction-groups, reported associative organization was associated with greater recall than reported rehearsal. The discussion dealt with the concept of "chunking" and the importance of S's reports of what he is doing, in predicting recall.

118. Eagle, M.N., & Ortof, Edna. The effect of level of attention upon "phonetic" recognition errors. *Journal of Verbal Learning and Verbal Behavior*, 1967, 6, 226-231.

Subjects were given a single presentation of 26 words, with instructions to try to memorize them under two different conditions: (a) focal attention, and (b) while simultaneously performing another task (distraction). The distraction group showed more recognition errors based on acoustic similarity (clang errors) than did the focal attention group. It was shown that these errors could not be attributed to failure of discrimination during stimulus presentation. Rather, the results can be explained by the hypothesis

that reduced attention tends to block analysis of incoming stimuli. Hence, some stimuli in the distraction condition were in memory primarily on the basis of assonance.

119. Eberlein, Eileen, & Raskin, D.C. Intrapair and interpair associations in verbal discrimination learning. *Psychonomic Science*, 1968, 11(4), 145-146.

As a test of the frequency theory of verbal discrimination (VD) learning, the effect of strong associations between items within pairs was compared to the effect of strong associations between correct and incorrect items in different pairs. The interpair associations produced significant interference in VD learning, whereas intrapair associations had no effect. The results raise questions about the adequacy of the frequency theory.

120. Edwards, D.C. Similarity in verbal discrimination. *Perceptual and Motor Skills*, 1966, 23, 815-820.

Two types of intralist similarity were investigated in 4-choice verbal discrimination learning of nonsense syllables and forms. Similarity among the four items of a display retarded learning a small amount or not at all. However, similarity of items among displays greatly retarded learning in all situations as compared to a control of minimal similarity. Presentation of displays of stimuli by the anticipation method, by the study-test method, or by presentation of the "correct" stimulus alone during the study phase of study-test method, influenced speed of learning also, listed in order of increasing speeds of learning.

121. Ehri, Linnea C., & Rohwer, W.D., Jr. Verb facilitation of paired-associate learning as a function of syntactic and semantic relations. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 773-781.

Fourth- and fifth-grade children were given a PA learning task. Experimental groups were exposed to nouns linked by verbs (sentences), while the control group saw conjunction-linked nouns. Effects of three independent variables were assessed: semantic relation of the verb with its nouns, test-trial stimuli, and verb construction. Performance varied as a function of the verb relation and test stimulus factors. Results suggest that verbs, in order to produce better noun pair learning than conjunctions, must be aroused during the test trial so that they can expedite retrieval of verb phrases where object nouns

are stored. Also, the findings indicate that verbs can cue recall as well as nouns and that verb-preposition connectives have the same effect on performance as verbs.

122. Ekstrand, B.R., Wallace, W.P., & Underwood, B.J. A frequency theory of verbal discrimination learning. *Psychological Review*, 1966, 73(6), 566-578.

The frequency theory of verbal-discrimination (VD) learning postulates that the cue for discrimination is the difference in frequency of occurrence between the correct (C) and incorrect (I) alternatives of a VD pair. It is postulated that, as VD learning proceeds, at least a 2:1 frequency difference in favor of the C item is built up, and Ss use this difference as their cue. By always selecting the item with the greater perceived frequency of occurrence, Ss can perform efficiently. An experiment was presented which produced results in support of the frequency theory. The discussion centered on additional predictions of the theory and the evidence available in support of these predictions.

123. Enburg, R.S. A test of two theories of associative clustering. *Dissertation Abstracts*, 1962, 23, 1794-1795.

Associative clustering refers to the tendency of subjects presented with a randomized list of stimulus words to recall the items of the stimulus list in sequences of related items. This tendency has been interpreted as reflecting the presence of some form of relationship which exists between the stimulus words. Two theoretical formulations regarding the type of relationship which influences associative clustering have been proposed. One theoretical position holds that associative clustering relfects the direct associative strengths of the stimulus words. Another theory has proposed that associative clustering is a function not only of the direct associative strengths of the stimuli, but that it involves some other type of relationship such as the presence of a categorical relationship between the stimuli.

The present research was undertaken to test these two theoretical positions, to see if associative clustering may reflect factors other than the direct association strengths of the stimulus words. Two stimulus lists were constructed, each of which comprised twelve word pairs. One of these lists had a direct associative relationship present between the members of the related pairs. The otherstimulus list was composed of word pairs of comparableassociative strength, but in addition a categorical relationship was present between the members of

the related pairs. These two stimulus lists were equated with with respect to the mean frequency of usage of the stimulus items, as reflected in the Thorndike-Lorge word counts, and with respect to the mean length of the stimuli both in terms of length in letters and in length in syllables. The stimulus items from each list were randomized and presented to groups of subjects, who were subsequently given a free recall period.

The analysis of the data indicated that there was no difference in regard to the recall of the stimulus items from the two lists. There was however, a significant difference between the two types of stimulus lists with regard to the incidence of associative clustering in recall. The list having a categorical relationship between the members of its related pairs, showed a significantly higher incidence of associative clustering, than was present for the list which had a relationship in terms of an associative strength between the members of a related pair. A significant difference was also found in the occurrence of significant associative clustering in the two lists, with the categorically related list having a higher incidence of significant associative clustering.

The results of these analyses were interpreted as supporting the position that associative clustering is a function of some form of categorical relationship between the stimulus words. This type of relationship does not appear to be accounted for by the associative strengths of the stimulus items, nor in terms of the Mutual Frequency Score. Suggestions for further studies, and theoretical implications were discussed.

124. Entwisle, Doris R., & Huggins, W.H. Interference in meaningful learning. *Journal of Educational Psychology*, 1964, 55(2), 75-78.

These experiments with beginning engineering students revealed negative transfer between the dual topics that form the principal subject matter of circuit theory. This negative transfer included both proactive and retroactive effects. Refinement of programed materials on circuit theory would not reveal this difficulty, and these experiments point up the dangers in premature crystallization of programed materials.

125. Evans, R.A. Word recall and associative clustering in mental retardates. *American Journal of Psychology*, 1964, 69, 413-418.

This study investigated the factor of measured intelligence and material incentive as they relate to word recall and associative clustering. Thirty-two adult male retardates were

divided into two groups on the basis of high and low intelligence and then redivided into subgroups which received the conditions of material incentive (candy or cigarettes) or no material incentive.

Each S was read randomized lists of twenty stimulus words taken from four conceptual categories, viz., animals, food, clothing, and parts of the body, on five consecutive trials. Following each trial Ss were asked to recall as many stimulus words as they could.

The results revealed that on words recalled brighter Ss tended to exceed duller Ss, and that the effect of material incentive was negligible. However, material incentive and low intelligence groups tended to produce more inappropriate responses (redundancies and intrusions) than their respective counterparts.

Finally, two indices of associative clustering were used. None of the experimental variables were related to either clustering measure. Problems regarding the effect of errors on clustering indices were discussed.

126. Fagan, J.F., III. Clustering of related but nonassociated items in free recall. *Psychonomical Science*, 1969, 16(2), 92-93.

Reliable category clustering was observed in free recall of words which rhymed but which did not elicit one another as free associates. Intrusions were phonemically similar to list items.

127. Feather, B.W. Semantic generalization of classically conditioned responses: A review. *Psychological Bulletin*, 1965, 63(6), 425-441.

25 experiments on semantic generalization of classically conditioned responses are reviewed. Several major methodological inadequacies are discussed. These included frequent failure to convincingly demonstrate conditioning, failure to distinguish between generalization effects and extinction effects, and failure to control for simultaneous conditioning to the generalization stimuli. 2 alternative inferred mechanisms of generalization are discussed. While mediation by common responses is not strongly supported by evidence, there is suggestive evidence of the importance of S's categorizing generalization stimuli as similar to the conditioned stimuli, as evidenced by Ss' reported expectation or reinforcement.

128. Fillenbaum, S. Memore of gist: Some relevant variables. *Language and Speech*, 1966, 9, 217-222.

Using sentences of the form: A is X, B is not X, C is $\overline{X}$ and D is not $\overline{X}$ (where X and $\overline{X}$ are antonyms) a study of gist memory was carried out concerned with evaluating two alternative proposals as to the way in which simple sentences might be remembered, viz. a "kernel" versus a "reading" hypothesis, and seeking to identify two possible variables that might modulate the gist effect, viz. the conceptual nature of the antonymy relation and the phonetic realization of this relation. With some variations in procedure the study was carried out in three separate replications which yielded mutually consistent results supporting the "reading" hypothesis, and indicating that, as expected, the gist effect was greater for contradictories than for contraries and for prefixed items (using the same root with and without negating prefix) than for unprefixed, phonetically distinct items; the effect of these variables was interactive. The results were considerably clarified when, in addition to an a priori or dictionary specification of item type, procedures were used to provide a judgmental specification. This finding was taken to indicate the value of, and need for, such additional behavioural characterization of linguistic materials.

129. Fillenbaum, S. Sentence similarity determined by a semantic relation: Learning of "converses". *American Psychological Association, Annual Meeting Proceedings*, 1968, 9-10.

130. Fillenbaum, S. Words as feature complexes: False recognition of antonyms and synonyms. *Journal of Experimental Psychology*, 1969, 82(2), 400-402.

For each item in a 240-word list that was orally presented, Ss had to indicate whether or not it had occurred previously. There were significantly more false recognition errors for (a) antonyms and (b) synonyms of preceding words than for control items matched with a and b for strength of associative relation to preceding words. There was no difference between the antonym and synonym conditions. These findings, which extend some earlier word of Anisfeld and Knapp on false recognition for synonyms, were taken as evidence for the view that a word is understood and stored in memory as a complex of features or attributes, systematic errors occurring when information on some feature (s) is lost.

131. Fingeret, A.L., & Brogden, W.J. Part versus who practice in the acquisition of serial lists as a function of class and organization of material. *Journal of Experimental Psychology*, 1970, 83(3), 406-414.

Each half of serial lists of 16 CVC nouns, two-digit numbers, and mixed materials (8 nouns or 8 numbers) was practiced separately in the part phase on alternate trials (AL), or the first part alone was practiced, followed by acquisition of the second (SUC). The whole list was practiced in the combination phase and throughout whole practice (WH). Both part methods were superior to WH for all materials. Errors increased from mixed materials to nouns to numbers for AL and WH. Mixed materials and nouns did not differ for SUC, but were superior to numbers. AL was superior to SUC for mixed materials, but inferior for nouns and numbers. Most errors for AL occurred during the part phase. Proportion of errors for part and combination phases varied with materials for SUC. Certain of these results and the form of serial position error curves indicate that the mixed-materials conditions involve a principle of organization.

132. Flavell, J.H. Meaning and meaning similarity: 1. A theoretical reassessment. *Journal of General Psychology*, 1961, 64, 307-319.

The major purpose of this paper is to propose a modification of Osgood's theory of meaning and meaning similarity. In this revised account, the meaning ($r_m \rightarrow s_m$) of a sign is said to include two classes of response: (a) responses to the attributes or properties which the subject discriminates the sign's referent object itself; (b) responses to the discriminated attributes of other, non-referent objects present in the physical context or surround of the referent object. It is believed that the semantic differential measures (a) but fails to measure (b). Since Osgood's index of meaning similarity between two signs, the D score, is based directly on the semantic differential profiles of the separate signs, it is likewise thought to be an incomplete measure. Two possible techniques are described for measuring that component of meaning similarity between signs which derives from the similiarity between their respective non-referent attributes. Finally, an experiment is proposed which tests the hypothesis that judged semantic similiarity best predicted by a combination of two measures: D score and one of the techniques for assessing the non-referent similarity.

133. Flavell, J.H., Draguns, J., Feinberg, L.D., & Budin, W. A microgenetic approach to word association. *Journal of Abnormal and Social Psychology*, 1958, 57, 1-7.

The present study constitutes an attempt to test certain general hypotheses derived from a microgenetic approach to word association. In the first two experiments, using college students as subjects, association responses given under time pressure conditions were compared with those given without time pressure. In the third experiment, word associations of a group of schizophrenics and a matched group of hospital aides were similarly compared, both groups in this case responding without time pressure. It was predicted that the word associations of the college students performing under time pressure would differ from those of the college students responding under free conditions in exactly the same way as the responses of the schizophrenics would differ from those of the aides. Further, the precise character of the group differences in question was specified in the hypotheses. These predictions were in part supported by the results. That is, several of the predicted group differences were confirmed and a partial congruence between student-student differences and schizophrenic-aide differences was found. An interpretation of these findings was suggested and possible directions for further research within a microgenetic orientation were specified.

134. Foley, J.P., Jr., & Cofer, C.N. Mediated generalization and the interpretation of verbal behavior: II. Experimental study of certain homophone and synonym gradients. *Journal of Experimental Psychology*, 1943, 32, 168-175.

This experiment was designed to demonstrate generalization (a) along more than one homophone gradient from a given stimulus word, (b) along a synonym gradient from the stimulus word, and (c) along a synonym gradient two degrees of transformation removed from the original stimulus word. Results seem to indicate generalization in all of these dimensions, and to this extent confirm the writers' previous theoretical analysis (I).

135. Forrester, W.E., & Spear, N.E. Sound coding in verbal learning with and without restrictions on decoding. *Psychonomic Science*, 1969, 17(2), 91-92.

A transfer design was used to assess the hypothesis that Ss may encode response terms as pronounceable sounds in learning a paired-associates list. The results indicated that the facilitative effects of sound coding are greatly diminished if S must use different decoding rules in learning original and transfer lists.

136. Fox, P.W. Patterns of stability and change in behaviors of free association. *Journal of Verbal Learning and Verbal Behavior*, 1970, 9, 30-36.

Several basic questions are raised concerning data generated by tests of free association: What is the upper limit of normative correspondence across associative collections? What is the temporal reliability of the individual S's free association behavior? Do cultural norms predict temporal changes in association by the individual S? Associations collected from the same Ss on two occasions 60 days apart revealed great normative stability. However, examination of each S's associates showed that over 50% of the responses differed from one occasion to the next, even though the group data comprising the cultural "norm" were nearly identical. Patterns of temporal change in association by the individual S were lawfully related to the strength of the cultural primary response.

137. Fox, P.W., & Bilodeau, E.A. Associative rules governing recall and misrecall. *Journal of Experimental Psychology*, 1966, 72(5), 731-735.

An experiment was performed to evaluate a new conception of the relationship between retention and forgetting. Ss were trained with the 2nd most frequent free-associative responses (R_2's) to kent-Rosanoff stimuli, and were tested for written recall of the R_2 words in the presence of the corresponding stimulus terms. Forgetting was fractionated into components of misrecall of which 2, intrusions of free-association primaries (R_1's) and intrusions of free-association responses R_3-Rn from the associative hierarchy (R_3-n's), were predominant. Correct recall of R_2 words was tested under 2 different associative rules: (a) $p(S \rightarrow R_2)$; and (b) $p(R_1 \rightarrow R_2)$. Misrecalls in each case were predicted by associative connections $p(S \rightarrow R_1)$ and $p(R \rightarrow R_2)$. The results support the hypothesis that retention and forgetting are 2 phenomena with multiple components subject to different associative rules.

138. Frase, L.T. Paragraph organization of written materials: The influence of conceptual clustering upon the level and organization of recall. *Journal of Educational Psychology*, 1969, 60(5), 394-401.

The written material in this study described eight attributes of six chessmen. In a 3 x 2 design, 42 high school graduates were given three free-recall trials to learn this information for the purpose of winning money by evaluating

chess play. The 48 sentences were ordered in three ways: (a) by the concepts (chessmen), (b) by the attributes, or (c) by randomization. Half of the Ss were told the conceptual structure of the passage before reading. Conceptual preinformation improved recall as trials progressed. Well-organized passages substantially improved acquisition, and also yielded primacy effects. Recall clustering was relatively high with all passages, but was significantly higher when the passage was organized by concepts. Ability to evaluate chess play correlated only with recall of three attributes relating to the moves of the men, and did not differ significantly for the experimental groups.

139. Freund, J.S., & Underwood, B.J. Storage and retrieval cues in free recall learning. *Journal of Experimental Psychology*, 1969, 81(1), 49-53.

Forty nouns were presented for a single learning trial. This was followed by free recall, which in turn was followed by cued recall in which 20 of the nouns from the list were shown S. To emphasize the use of particular cues in learning, four different instructional conditions were imposed prior to learning. Orthogonal to these conditions were three different types of cue emphases in presenting the 20 words prior to cued recall. The 12 groups each contained 28 college students as Ss. The instructional conditions for learning emphasized serial position (SP), alphabetical organization (AL), interitem associations (IA), or control. The three types of lists at cued recall were appropriate to SP, AL, and IA. Free recall was enhanced by SP and IA, but not by AL. Cued recall resulted in an average increment of less than one-half word and did not differ for the 12 conditions. It was concluded that free recall exhausts the storage.

140. Frincke, G. Word characteristics, associative-relatedness, and the free-recall of nouns. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 366-372.

In Exp. 1, relationships between word imagery, concreteness, Noble's meaningfulness (m), rated meaningfulness, rated familiarity, Thorndike-Lorge frequency, trigram frequency, word goodness, evaluative polarity and word length, as well as their relations with free-recall learnability, were investigated. Measures of the word characteristics and an ease of free-recall score (FR) were obtained for 74 nouns. Factor analysis revealed two common factors, meaningful-familiarity and imagery-concreteness, underlying the relationships observed. Only imagery-concreteness was related

to FR. In Exp. II it was found that words high in imagery-concreteness are more readily organized or clustered into groups than abstract, low imagery words. Imagery remained significantly related to FR when ease of clustering was held constant. It was suggested that another process, perhaps attention, may also be involved in the determination of FR. When corrected for attenuation due to the less than perfect reliability of FR, a multiple R = .82 was obtained between FR and imagery, associative relatedness, and rated meaningfulness.

141. Fulkerson, F.E., & Kausler, D.H. Effects of intrapair and interpair bidirectional associates on verbal-discrimination learning. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 307-310.

The present study replicated a previous one by Eberlein and Raskin (1968) in finding that a verbal-discrimination list composed of bidirectional word associates as interpair wrong (W) and right (R) items is more difficult to learn than a list in which the word associates enter into intrapair W and R relationships. Moreover, the acquisition of the intrapair list did not differ in difficulty from the acquisition of a list composed of unrelated words, again in agreement with previous studies. Free-recall measures of W and R items indicated that the intrapair and interpair conditions differed primarily in the process employed to "tag and collapse" pairs of item for use in the recognition of R items during verbal-discrimination practice.

142. Gaeth, J.H., & Allen, Doris, V. Effect of similarity upon learning in children. *Journal of Experimental Child Psychology*, 1966, 4, 381-390.

It was hypothesized that formal intralist similarity would interfere more with paired-associate learning in children than would conceptual similarity. Performance in five experimental and two control conditions was examined for Grades 4-6. Formal similarity interfered more with the learning of items low in meaning while conceptual similarity seemed to interfere more with highly meaningful material. Overall, children respond like adults to the various dimensions of similarity.

143. Gagne, R.M. Context, isolation, and interference effects on the retention of fact. *Journal of Educational Psychology*, 1969, 60(5), 408-414.

In the setting of a science lesson, children of Grades 4 and 5 were given five facts to learn and remember. Several different kinds of presentations were employed, including massed and spaced accompanying contexts containing (a) a related superordinate fact in the form of a topic sentence, (b) coordinate facts, (c) unrelated facts, and (d) an "isolated" presentation condition containing no context facts. Retention of the facts was measured primarily by recall scores obtained by having the children complete blanks in paraphrased sentences. Results indicated significant effects of the variables of school grade and type of context, but no significant effects of massed versus spaced presentation. Most favorable condition for recall was one with no context during learning. Superordinate context was superior to coordinate, and this in turn superior to unrelated context. The results are interpreted as indicating the operation of interference, and also of organizing factors, in the determination of retention.

144. Gallagher, J.W. Semantic relationship and the learning of syntactic word pairs in children. *Journal of Experimental Child Psychology*, 1969, 8, 411-417.

The present study examined the influence of semantic consistency (meaningfulness) and anomaly on the learning of three types of syntactic pairs. The results showed that meaningful pairs are learned with fewer errors than anomalous pairs. The difference between meaningful and anomalous pairs increased from kindergarten to grades 1 and 3. This was interpreted as a manifestation of the development of the semantic system. However, there was a decrease between the meaningful and anomalous pairs from grade 3 to grade 5. Meaningful noun-verb and adjective-noun phrases were learned with fewer errors than verb-noun phrases. No differences were found among types of phrases for the anomalous pairs.

145. Gardner, R.W., & Lohrenz, L.J. Association and recall. *Perceptual and Motor Skills*, 1962, 15, 29-30.

51 Ss heard a list of CHEESE associates and control words following five subliminal exposures of CHEESE; 44 Ss heard the same list without prior subliminal stimulation. Both groups recalled more CHEESE associates than control words. Superior recall of CHEESE associates is apparently due to their common associative link, rather than to a subliminal effect.

146. Garskof, B.E., & Houston, J.P. Measurement of verbal relatedness: An idiographic approach. *Psychological Review*, 1963, 70(3), 277-288.

A theoretical model was developed in which the associative meaning of a word was defined as the set of associates evoked by that word. The relatedness between 2 words was postulated to be dependent upon the degree of overlap of their respective associative meanings. A measure of relatedness was described between words. 3 experiments which investigated the use of this measure were reported. A high positive correlation was found between values of the measure and subjective judgments of relatedness. It was also found that individual differences in creativity affect the stability of the measure and the appropriateness of particular weighting exponents used to compute the measure.

147. Garskof, B.E., & Houston, J.P. Supplementary note: Recall as a function of word association strength and associative overlap. *Psychological Reports*, 1964, 14, 185-186.

18 Michigan undergraduates were read a list of 20 word pairs which varied systematically in terms of both word association strength and associative overlap. An attempt was made to reduce intentional learning of the pairs. Following 40 min. of interpolated paper-and-pencil activity Ss were presented the stimuli and asked to recall the responses. Both word association and associative overlap strength correlated positively with recall. These results, obtained under conditions of incidental learning and interpolated activity, parallel results obtained with immediate recall following intentional learning.

148. Garskof, B.E., Houston, J.P., & Ehrlich, N.J. Inter- and intra-hierarchical verbal relatedness. *Journal of Verbal Learning and Verbal Behavior*, 1963, 2, 229-233.

Two measurement techniques have been used to assess associative strength between words, conventional word association, and the associative overlap. The former is a measure of the relative importance of individual meaning responses in their associative hierarchies and the latter measures similarity in the distribution of partial meaning responses. We have called these two kinds of associative strength Intra-hierarchical Relatedness and Inter-hierarchical Relatedness, respectively. A clustering and a retention experiment were performed to determine if these two kinds of associative strengths operate independently. The results

indicate that, dependent upon the nature of the task, both may independently influence verbal behavior.

149. Gellman, Estelle Clustering as a factor in recall. *Dissertation Abstracts*, 1969, 30(B), 3504-3505.

The purpose of this study was to determine the extent to which the positive relationship between the degree of clustering and the number of words recalled from a stimulus list could be attributed to the process of clustering, and to examine the process whereby clustering might facilitate retention of verbal material.

The hypotheses tested were that, after the first recall of a stimulus list, and if no further learning trials are given:

1. More non-clustered words than clustered words will be forgotten on later recalls of the stimulus list.

2. A clustered word is more likely to be lost if its associate is also lost than if its associate is not lost.

3. Instances in which one member of a cluster is forgotten, or in which the members of a cluster are separated on subsequent recalls, will more often occur with pairs of moderate associative strength than with pairs of high associative strength.

4. Both clustering and recall of the same associative pairs will be higher when these pairs are presented on a stimulus list composed entirely of associative pairs than when they are on a stimulus list composed of both associative pairs and "unrelated" words.

In order to test the hypotheses, two stimulus lists were constructed. One list was composed of six highly and six moderately associated pairs: the other was composed of the same six highly associated pairs and twelve "unrelated" words. The subjects were all college students, and each list was presented to a different group of subjects. Each group of subjects had one learning session and three recall tests.

The results indicated that the clustered words were better retained than the non-clustered words, that more pairs of moderate associative strength were dissociated than pairs of

high associative strength, that more clustered words were lost with their associates than alone, and that there was no difference between the lists in the number of highly associated words recalled nor in the degree to which these words were clustered. The results also indicated that the better retention of the clustered words could, in the case of moderately associated words and the highly associated words recalled from the mixed list, be attributed to the fact that those words were clustered.

It was concluded that clustering is a factor that facilites recall, and that such facilitation occurs by means of a coding process. The subject codes the related words into clusters, and the recall of the unit code, or of one member of the cluster, cues the recall of the other members.

150. Gerjuoy, I.R., & Spitz, H.H. Associative clustering in free recall: Intellectual and developmental variables. *American Journal of Mental Deficiency*, 1966, 70, 918-927.

Adolescent educable retardates, equal MA normals, equal CA normals and college students were presented a 20-item list consisting of five words from each of four categories. A different random order was given on each of five trials. On a measure of clustering, only equal CA and college Ss clustered above chance. On recall, retardates and equal MA Ss did not differ; both groups recalled significantly less than equal CA and college Ss.

Presenting the stimulus words in categories or requesting Ss to recall the words in categories increased the recall of retardates. A combination of these two experimental conditions produced the greatest amounts of recall by retardates.

151. Glanzer, M. Distance between related words in free recall: Trace of the STS. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 105-111.

Two experiments on free recall are presented in which pairs of related words are presented within the lists and the number of words intervening between the related pair is systematically varied. In Exp. I the relation was a mnemonic, or assocative, relation. In Exp. II the relation was repetition. A second variable in both experiments was presentation rate. In both experiments, systematic, monotonic effects of the number of intervening items were found. The relevance of the effects to a model that postulates two distinct storage mechanisms--an STS and LTS--is discussed.

152. Glanzer, M., Gianutsos, R., & Dubin, S. The removal of items from short-term storage. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 435-447.

A series of five experiments was carried out to determine what factors are involved in the removal of items from STS in free recall tasks. The technique used was to vary characteristics of delay tasks given after list presentation. The alternatives considered were (a) information load or task difficulty, (b) interference effects stemming from similarity, (c) number of words processed, (d) passage of time. The results indicated that the number of words processed in the critical variable. The other variables listed above showed little or no effect on STS. A simple displacement model for STS was discussed.

153. Glucksberg, S., & Balagura, S. Effects of repetition and intra-array similarity upon very short-term visual memory. Paper presented at Psychonomic Society meeting, October, 1965.

Repeated stimuli were used in a task modelled after Sperling's technique of partial report (1960). The basic task was to report letters that were tachistoscopically presented. On each trial, three rows of 6 consonants each were presented. After a delay of either zero or one second, an auditory post-stimulus cue was used to instruct the subject to report the contents of the high, the middle, or the low line. If a high tone sounded (7000 cps), S was to report the contents of the high line, a middle tone (700 cps) cued the middle line, and a low tone (70 cps) cues the bottom line.

Four levels of intra-array similarity were used in a replication of Sperling's study, with 6 delays of report.

The results indicate that until we can come up with a more appropriate similarity dimension, the decay interpretation of very short term visual memory stands. The properties originally, and apparently inappropriately, attributed to short term memory (3-19 seconds) may very well be applicable to very short term memory (visual, under one second). That is, activity traces, and autonomous decay, seem applicable concepts to the kind of storage involved here...storage of a primarily sensory nature.

And if, indeed, short term storage of this kind is primarily a sensory phenomenon, then interference effects should be modality-specific, as suggested by the work of Steffy & Eriksen (1965). If so, then very short-term storage

differs from long-term in this very respect, long-term and ordinary short-term interference effects being relatively independent of stimulus presentation modality.

154. Glucksberg, S., & Danks, J.H. Functional fixedness: Stimulus equivalence mediated by sematic-acoustic similarity. *Journal of Experimental Psychology*, 1967, 74(3), 400-405.

Ss were required to refer to a metal tool with E-assigned names while working on a problem in which that tool had to be used as a substitute for wire. Problem solving was facilitated when the assigned tool name rhymed with the word wires. When both the tool and wire were assigned nonsense-syllable names, no effect of rhyming was obtained, indicating that generalization along an acoustic semantic rather than a phonetic dimension mediated functional equivalence.

155. Glucksberg, S., Fisher, D.F., & Monty, R.A. Brief visual memory as a function of visual and acoustic confusability. *American Psychological Association, Annual Meeting Proceedings*, 1967, 55-56.

Twelve U.S. Army enlisted men between the ages of 21 and 25 were given a BVM task patterned after Sperling's technique of partial report (1960). Each stimulus card contained an array of three rows of six letters each. Either 0.7 sec. before each array was presented, or after a specified delay, an auditory cue instructed S to report the contents of the high, middle, or low line. The high, middle and low tones were, respectively, pure since waves of 7,000, 700, or 70 Hz.

Four sets of 30 six-letter sequences were constructed, one set for each of four consonant "vocabularies." The vocabularies were chosen on the basis of visual and acoustic confusability.

Each S was given 72 trials a day for 6 days. Three delay conditions were employed: --0.7 sec. (advance cue, informing S which line would be called for), zero sec., and 1 sec. Each delay condition was given in blocks of 24 trials, with order of delay conditions counterbalanced across days and Ss. The measure of performance was the mean number of items correct in ordered report during the last 3 testing days.

These data suggest rather strongly that, insofar as interference effects are concerned, STM and BVM are dissimilar in at least two respects. First, visual, rather than acoustic, confusability effects BVM. Second, the time course of the

interference effects in BVM is opposite to that generally found in STM; as recall interval increased, interference effects decreased. This suggests that the major effect of visual confusability is upon imput rather than upon storage. The particular form of the interaction obtained is more consistent with a decay interpretation of forgetting in BVM than with an interference interpretation.

156. Gonzalez, R.C., & Cofer, C.N. Exploratory studies of verbal context by means of clustering in free recall. *Journal of Genetic Psychology*, 1959, 95, 293-320.

A number of experiments have been reported in which was utilized Bousfield's method for studying clustering in free recall. Bousfield's technique was modified, in many of the experiments, by the use of modifiers for nouns or other parts of speech. The subjects were college students, run ordinarily in groups. A single oral presentation of the list was usually made, followed by an immediate recall, a filled five minute interval, and a second or delayed recall. Some of the chief results and conclusions are as follows:

1. A specificity effect. When adjectives are chosen so that they do not belong to mutually exclusive categories and hence do not cluster and are used to modify appropriately only the nouns with which they are individually paired, the result is that the nouns become specific in their meaning and no longer show the clustering which, unmodified, they do.

2. Mediational effects. Adjectives and nouns when they belong to a small number of categories show clustering by themselves, i.e., in a list of adjectives alone and in a list of nouns alone. If nouns which do not cluster alone are presented in pairs with adjectives which do cluster, the nouns cluster in terms of the adjective categories. When adjectives which do not cluster alone are paired with nouns which do, the adjectives show clustering when score for the noun categories. Adverb and verb lists can be developed which independently show clustering.

3. Facilitation effects. When clustering adjectives and clustering nouns were set up in pairs so that the adjective categories and noun categories were congruent with each other, clustering and recall of nouns were facilitated. Similar facilitation

effects were not demonstrated with adverb and verb combinations or with combinations of four words--adjective-noun-verb-adverb. However, with one exception, in these two cases clustering was not disrupted, and item recall in the four word combinations was disrupted.

4. A conflict effect. When categorized adjectives were set to modify nouns so that the adjective categories cut across the noun categories, clustering and recall were adversely affected, even though the modification was appropriate.

5. Interference effects. (a) Inappropriate adjective modifiers, presented in the original list, have disruptive effects on clustering and on recall of items; this effect is much pronounced, when the adjective-noun pair, rather than the noun alone, must be recalled. In general, the pair recall task is more difficult than the noun recall task and shows effects, also, from appropriate adjective modification. It is likely that pair recall in some of our experiments reveals the specificity function of adjectives, which, in the case of inappropriate modification, is associated with interference. (b) In a retroactive interference experiment, item recall but not clustering was shown to be affected by interpolated interference.

6. A tentative account is offered of the process of recall in this general situation, involving coding, associative and response strength factors. The results of our various experiments are summarized in terms of this account. It is further suggested that meaningful research with connected material can be pursued involving the variables and "principles" of adjective modification identified in these studies.

157. Goss, A.E., Nodine, C.F., Gregory, B.N., Taub, H.A., & Kennedy, K.E. Stimulus characteristics and percentage of occurrence of response members in paired-associates learning. *Psychological Monographs*, 1962, 76(Whole No. 531), 1-27.

The five experiments reported here represent a convergence of often separate interest in acquisition and possible extinction of correct anticipatory responses of paired-

associate (PA) units as functions of four classes of variables: (a) percentage and patterning of occurrences of response members of PA units; (b) similarity (Sim) among stimulus members (St) and among response members (R) of PA units; (c) association values or meaningfulness (M) of St and of R of PA units; and (d) prior familiarization (Fam) with the stimuli. The first of three overall objectives of these experiments was to determine effects of percentage of occurrence of response members (%ORM) on acquisition and possible extinction of anticipatory responses with lists representing different combinations of Sim and M of St and R. The second objective was to obtain further information about acquisition and possible extinction of anticipatory responses functions of Sim and M of St and R. The third objective was determine whether Fam with St and R would influence acquisition and possible extinction and, if so, whether the extent of such effects was contingent on variations in one or more of the other variables.

The particular combination of variables of each experiment is described subsequently. Of greater interest here is the significance of each of these classes of variables, both singly and together, for predictions of relative rates of acquisition of correct anticipatory responses and of relative frequencies of those responses under a postacquisition schedule of no further occurrence of response members.

158. Goulet, L.R. Verbal learning in children: Implications for developmental research. *Psychological Bulletin*, 1968, 69(5), 359-376.

Current research in verbal learning is reviewed in terms of its implications for developmental research. Suggestions are provided which relate to the methodology of research incorporating age as a treatment variable in addition to highlighting the analytical utility of verbal learning paradigms in the study of developmental learning processes. The similarities of theory and data relating to nonverbal tasks (e.g., probability-learning, transposition, reversal-shift, and discrimination-learning paradigms) and to theory concerning the interaction of verbal learning and development are also discussed.

159. Gray, S. Acoustic similarity in long-term memory. Unpublished master's thesis. Ohio State University, Columbus, Ohio, 1968.

80 Ss were divided into four groups and were given two paired-associate lists, the second of which was the same for all groups. Both lists were learned to a criterion of one perfect trial. Results showed that significant negative transfer occurred with a list of acoustically antagonistic responses, while slight but non-significant negative transfer occurred with a list of acoustically similar responses. The results were interpreted to support the contention that acoustic factors produce interference in LTM.

160. Greene, Judith, M. The semantic function of negatives and passives. *British Journal of Psychology*, 1970, 61, 17-23.

The hypothesis was tested that syntactic constructions would be easier to deal with when they were being used for their natural semantic function rather than for an unnatural function. The experimental task required subjects to decide whether pairs of sentences had the same or a different meaning. The results confirmed the prediction that deciding about pairs of affirmative and negative sentences would be relatively facilitated when the negative was performing its natural function of signaling a change of meaning. In contrast, performance was facilitated when pairs of active and passive sentences had the same meaning. These results are discussed in connexion with the relation between syntactic competence and semantic context.

161. Greenhouse, Phyllis. Free recall of categorized and unrelated words under serial or grouped presentation. *Psychonomic Science*, 1967, 8(10), 447-448.

Sixty Ss were presented a list of 52 categorized or unrelated words for three free recall trials. The items of the list were read either serially or temporally grouped. The initial effect of the temporal procedure was to depress number of categories in recall. By Trial 3 it had facilitated both the number of words and clusters in the recall of unrelated words and the number of categories of related words.

162. Grossman, L., & Eagle, M. Synonymity, antonymity, and association in false recognition responses. *Journal of Experimental Psychology*, 1970, 83(2), 244-248.

In two experiments on false recognition, one employing the method of continuous recognition and the second involving separate stimulus and recognition lists, Ss made significantly more false recognition responses (i.e., said that a word had been presented before when it had not been) to synonyms and associates of stimulus words than to control words. No significant results were obtained for antonyms. Strength of associative relationship between related words and stimulus words (as determined by word association norms) was not significantly related to false recognition. These results support the idea that semantic relationships can form the basis for false recognition and also support Anisfeld and Knapp's idea that words are stored as complexes of features.

163. Gruneberg, M.M. Theoretical note: Logical objections to a dichotomous theory of memory. *Psychological Reports*, 1969, 24, 606.

To argue that relatively stable retention is only a sufficient condition for LTM entails the possibility that all materials enters LTM direct and makes any measurement of operational differences between STM and LTM impossible. It seems clear that, if Adams is correct, as he appears to be, in assuming that rapid forgetting cannot distinguish between STM and LTM, dichotomous theory cannot be verified and being less parsimonious than continuity theory must be abandoned in favour of the latter.

164. Gruneberg, M.M., & Sykes, R.N. Semantic and acoustic coding in short- and long-term memory. *Psychological Reports*, 1969, 25, 849-850.

This paper considers the evidence for semantic processing in STM. It is concluded that there is sufficient evidence of semantic processing in STM to make it impossible to dichotomize between long- and short-term memory on the basis of semantic coding being exclusively employed by long-term memory.

165. Gumenik, W.E. Effects of articulatory activity and auditory, visual, and semantic similarity on the short-term memory of visually presented paired associates. *Journal of Experimental Psychology*, 1969, 82(1), 70-74.

Auditory similarity among stimuli significantly increased errors in short-term memory (STM) of visually presented paired associates, while visual and semantic similarity did not. Reading the pairs aloud at presentation facilitated STM, but there were no differences between conditions in which the pairs were silently read and in which tongue and lip movements were restricted. Both primacy and recency effects were found in the silent reading and restricted movement condition, but only primacy effects were found in the aloud condition. Results were interpreted as being consistent with an auditory trace rather than a motor feedback hypothesis of STM.

166. Hall, J.W. Word recognition by children of two age levels. *Journal of Educational Psychology*, 1968, 59(6), 420-424.

2 words lists were presented aurally to kindergarteners and third graders. List 1 was presented under free learning instructions with half the Ss at each age pronouncing words aloud after presentation. For List 2, Ss reported whether each word had occurred in List 1. List 2 included 10 "new" words which were associates of List-1 words and 10 which were not (experimental--EX and control--C words, respectively). 5 List-1 words were repeated in List 2. More EX than C words were falsely recognized as having occurred in List 1, indicating that EX words occurred as implicit associative responses (IARs) during presentation of List 1. IAR-produced false recognitions were more frequent for younger than for older Ss and for pronouncing compared with nonpronouncing Ss. Recognition of repeated words was facilitated by overt pronouncing for kindergarteners.

167. Hall, J.W. Errors in word recognition and discrimination by children of two age levels. *Journal of Educational Psychology*, 1969, 60(2), 144-147.

Twenty familiar words (stimulus words) were presented aurally to each of 27 first- and 27 fourth-grade children. Each S responded aloud to each stimulus word with the first word (response word) that came to his mind. Next, the 20 stimulus words, the 20 response words, and 20 "new words" were presented in random order with S instructed to specify in which of the three categories each word belonged. Errors in which a stimulus word or a response word was either not recognized as having occurred previously or was recognized but still misclassified, were more frequent (a) for the younger than the older Ss, and (b) for the response words than for the stimulus words.

168. Hall, J.W., Sekuler, R., & Cushman, W. Effects of IAR occurrence during learning on response time during subsequent recognition. *Journal of Experimental Psychology*, 1969, 79(1), 39-42.

Each of 20 Ss was presented with two lists of words. In List 2 were (a) words strongly associated with certain words appearing in List 1 (E words), (b) words not associated with any List 1 words (control or C words), and (c) words repeated from List 1 (R words). For each List 2 word S indicated whether or not it had occurred in List 1. Speed for correct responses to C words was significantly greater than for correct responses to E words. Speed for correct responses to R words was significantly greater than for incorrect responses to E words. These results are interpreted by a model of recognition memory performance within a signal detection framework. Choice times are proposed as a useful index of the occurrence of implicit associative responses.

169. Hall, J.W., & Ware, W.B. Implicit associative responses and false recognition by young children. *Journal of Experimental Child Psychology*, 1968, 6, 52-60.

Two experiments concerned with implicit verbal behavior in young children are reported. In Exp. I, 86 elementary school children were presented a word list containing several critical stimulus words (e.g., SCISSORS) that possess strong natural-language associates (e.g., CUT). Next, a recognition list was presented that included (a) the associates of the critical stimulus words, and (b) control words (i.e., words not associated with any words on the learning list). It was assumed that if the experimental words had been elicited as implicit responses by the critical stimulus words, then these experimental words frequently would be falsely recognized as having appeared on the learning list. False recognitions did occur more frequently to experimental than to control words, confirming results obtained with adults by other investigators.

Experiment II employed 24 kindergarten and 24 third-grade children. Prior to presentation of the learning list certain of the critical stimulus words from that list were used as stimulus words in PA learning, with nonassociated words used as response terms (e.g., SCISSORS-BATH). Then the learning and recognition lists were presented. No false recognition effect was obtained either for the associates developed during PA learning or for the natural-language associates of the critical stimulus words that had been used in PA learning. However, a reliable false recognition effect was obtained for natural-language associates of critical stimulus words that had not been used in PA learning. These results suggest that

the PA learning functioned to temporarily extinguished the natural-language associates but did not raise the strength of the "new" responses to the point that they were produced as IARs.

Experiment II also examined false recognition as a function of CA, and found this effect reliably greater for the younger than for the older Ss. This finding is discussed with respect to the development of verbally mediated behavior.

170. Heckelman, S.B., & Spear, N.E. Effect of interitem similarity on free learning by children. *Journal of Verbal Learning and Verbal Behavior*, 1967, 6, 448-450.

Free learning of word lists was tested in children from grades 2 to 6. Two different methods of measuring interitem associative strength were shown to improve immediate free recall more than comparable word lists distinguished by orthographic similarity; in turn, recall of these latter list was better than comparable list of unrelated words. Furthermore, it was determined that free learning is influenced by intralist similarity in much the same way at each grade (age) level. Apparently, the usefulness and impact of associative and orthographic relationships extend down to typical second grade students whose language habits have already largely taken shape.

171. Hefele, T.J., & Liebergall, J. Associative intructions in short-term recall: A replication of Wickelgren. *Psychonomic Science*, 1969, 16(4), 173-174.

Thirty-two undergraduates listened to lists of nine letters presented at the rate of four letters per second and then attempted to recall the letters in the correct order. Letters following repeated letters tended to be interchanged in recall. Such associative intrusions were observed whether the repeated letters occurred at the beginning or middle of the lists, whether they were separated by one or two letters, and whether or not the items following the repeated items had a common vowel phoneme. Except for a failure to confirm the backward intrusion phenomenon, the results agreed with the earlier findings of Wickelgren (1966) and added to the data base supporting Wickelgren (1969).

172. Heim, A.W., Watts, K.P., Bower, I.B., & Hawton, K.E. Learning and retention of word-pairs with varying degrees of association. *Quarterly Journal of Experimental Psychology*, 1966, 18, 193-205.

The main aim of this experiment was to compare the role of degree of meaningfulness with that of frequency of repetition, in the learning and retention of word-pairs. The (student) subjects were divided into three groups. The first group learned 25 word-pairs whose members were frequently and highly meaningfully associated with each other. The second group learned 25 word-pairs which were associated far less frequently and meaningfully whilst those of the third group were as lacking in associative value as possible. The stimulus-words were ambiguous; they were identical for each of the three groups; the word-pairs were presented, in randomized order, repeatedly, during the learning stage until the subject achieved the criterion of 20 (or more) correct word-pairs. After an interval of 60-90 days, the subjects were retested for retention.

The results indicated that degree of meaningfulness plays a greater role than does frequency of repetition, both in learning and in recall; that the role of repetition tends to increase, however, as the meaningfulness of the material decreases; and that individual differences in method of learning increase with the difficulty of the material to be learned.

173. Henley, Nancy, M., Noyes, H.L., & Deese, J. Semantic structure in short-term memory. *Journal of Experimental Psychology*, 1968, 77(4), 587-592.

This paper reports an experiment on semantic structure in short-term memory. A selected portion of the English kinship system provided the semantic structure. Kin terms were drawn from a model having 3 dimensions or features--sex, generation, and lineality-collaterality. 8 terms were used in every possible combination of triads. These triads were presented to Ss who were instructed to recall them on signal. Counting backwards by 3s occupied Ss between presentation and recall. The recall intervals were 4, 8, and 16 sec. Results showed that recall was poorer for triads in which the terms differed by all 3 features rather than only by 2. An analysis of errors showed that more intrusions occurred with 3 features than with 2.

174. Hess, J.L., & Simon S. Extra-list intrusions in immediate free recall as a function of associative strength in children. *Psychological Reports*, 1964, 14, 92.

After collecting word-association norms for 12 high frequency responses to 36 stimulus words drawn from the Minneasota norms (3), Deese (2) found that the relative frequency of occurrence of a stimulus word as an associate to these responses was significantly correlated with the extent to which the stimulus word occurred as an extra-list intrusion in test of immediate free recall. Using college students as Ss, the product-moment correlation between the frequency of occurrence of the stimulus word as an associate and the frequency of occurrence of the stimulus word as an intrusion was .873. The purpose of the present study was to examine this same relationship in grade school children. The procedure employed by Deese (2) was followed as closely as possible with three exceptions: fewer recall lists and words per list were used, the recall test were administered in groups rather than individually (1) and the word associations were collected by having E read the stimulus words aloud instead of having the stimulus words printed on sheets of paper.

Ss were school children drawn from the 4th, 5th, and 6th grades. In Part I of the experiment, 19 free recall tests consisting of 10 high frequency responses each were administered to 29 Ss each from these grades. The stimulus and response words were culled from word-association norms collected by Simon, Lotsof, and Pease (4) from 399 4th, 5th, and 6th grade children. In Part II of the experiment, word-association norms were collected from 90 different Ss drawn from the same population as that employed in Part I of the experiment.

For all grades combined, the product-moment correlation between the number of times the stimulus word occurred as a free association in Part II and the number of times the stimulus word occurred as an intrusion in Part I was .725 ($p < .01$). The correlations for the 4th, 5th, and 6th grades, respectively, were .675, .719, and .604 ($p < .01$ in all three instances). None of the latter rs were significantly different from one another. These results agree well with those reported by Deese (1) and suggest that his findings may reliably be extended to include children in th 4th, 5th, and 6th grades.

175. Hintzman, D.L. Classification and aural coding in short-term memory. *Psychonomic Science*, 1965, 3, 161-162.

Analysis of errors in a short-term memory task indicates that Ss adopted two possible coding strategies: digit vs. letter categorization and subvocal or aural rehearsal. White noise had no effect on types of errors made or on over-all performance, but did bring out the usually convert rehearsal procees. Evidence from errors and effects of noise point to a reinterpretation of "auditory" coding in terms of kinesthetic feedback produced by subvocal rehearsal.

176. Hintzman, D.L. Articulatory coding in short-term memory. *Journal of Verbal Learning and Verbal Behavior*, 1967, 6, 312-316.

Confusion errors in short-term memory for visually-presented nonsense syllables were analyzed to determine the influence of two articulatory features of consonants: voicing and place of articulation. Both were found to contribute to confusions. Results are interpreted as consistent with a hypothesis of mediation by kinesthetic cues arising from subvocal rehearsal, and inconsistent with a hypothesis of mediation by an auditory image.

177. Hintzman, D.L. Backward recall as a function of stimulus similarity. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 348-387.

In 2 experiments, Ss mastered 8-pair paired-associate list containing 4 highly similar and 4 dissimilar CCC trigram stimuli paired with 8 single-digit responses. The Ss were tested for backward recall after reaching mastery of the list. Backward recall of the similar items was superior to that of the dissimilar items. This outcome was predicted by discrimination net theory. On the similar stimuli, Ss recalled all 3 letters about 70% of the time. On the dissimilar stimili, Ss recalled 1, 2, and 3 letters about equally often, and the letter in position 1 was recalled more frequently than those in positions 2 and 3.

178. Hodge, M.H., & Fox, W.F. Sequential short-term retention as a function of probability of recall of category items. *Journal of Verbal Learning and Verbal Behavior*, 1966, 5, 228-233.

Sixty college students were asked to perform a sequential retention task in which the probability of recall (PR) of the stimulus words from 0, 2, or 4 categories was either .00, .25,

.50, .75, or 1.00. All Ss, equally divided among the three category conditions, were presented 16 sequences of 24 items (4 sequences for each PR) on each of four successive days. Increases in PR and increases in the number of categories in which PR < 1.00 led respectively to significant decreases and increases in the mean proportion of correct responses at recall. It was suggested that variations in PR and in the number of categories affect performance by producing differential information-processing demands on S.

179. Hodges, W.L. The effect of task discriminability, response similarity, and learning ability on retroaction. *Dissertation Abstracts*, 1962, 22, 2883.

The present study was undertaken in an effort to clarify the effect on retroactive inhibition of varying degrees of meaningful response similarity under two different degrees of discriminability among original learning, interpolated learning, and recall and relearning and with subjects of differing degrees of verbal learning ability.

Eighty college freshmen were selected as Ss on the basis of their scores on the American Council on Education Psychological Examination Linguistic scores--40 from the lowest one-fourth and 40 from the upper one-fourth of their class. Each group was subdivided randomly and assigned to either a high or low discriminability condition which was defined by the use of different instructions. The low discriminability instructions followed common laboratory procedures while the high discriminability instructions were designed to aid Ss in making discriminations among the learning tasks employed.

All 80 Ss learned to pair 12 responses in original learning and 12 responses interpolated learning to identical stimuli following the traditional retraction paradigm and using the anticipation method. The 12 responses were divided into four response subset so that in interpolated learning three responses were the same, three were similar in meaning, three were neutral in meaning, and three were opposed in meaning when compared to their counterparts in original learning.

Relearning and Recall data were submitted to analysis of variance, and, since differences were obtained on the original learning task, the relearning data were submitted to an analysis of covariance to remove the effect of these initial differences.

It was found that the instructions intended to make discriminations among tasks easier reduced interference. The patterns of interference for low and high ability Ss were different across the Response Similarity Dimension.

The implications drawn from the results of the present study were that individual differences in verbal learning ability as measured by a standardized test may be useful in predicting different patterns of retroactive interference, that instructions designed to point up distinctions among competing learning tasks can lead to a reduction in interference, and that certain conflicts in the results of previous studies may be resolved by examining the materials learned and individual differences among Ss employed.

180. Holborn, S.W. Proactive inhibition in short- and long-term memory as a function of acoustic similarity and modality. *Dissertation Abstracts*, 1968, 28-B, 2220.

The present experiment had four basic objectives: (1) to assess amount of PI as a function of acoustic similarity (AcS) and modality (Mo): (2) to examine possible increases in PI over time: (3) to determine the effect or repeated measurements (stage of practice, cycle of testing) on retention; and, most importantly, (4) to compare STM and LTM under common learning and retention procedures.

Sixteen independent experimental groups of 32 Ss each were included in a 2 x 2 x 4 x 2 factorial design. Between-Ss variables were Mo (aural vs. visual presentation), AcS (high vs. low), retention interval (0, 3, 24, 360 sec.), while cycle of testing (Cycle 1 vs. Cycle 3) was the sole within-Ss variable. Acoustic similarity was manipulated between the stimulus terms of two PA lists conforming in the case of high AcS to the A-B, A'-C paradigm, and in the case of low AcS to the A-B, C-D paradigm. A common second (A-B) list was employed for the two paradigms. The 0-sec. retention interval was used for degree of learning estimations, while 8 and 24 sec. corresponded to STM intervals, and 360 sec. to an LTM interval. Eight independent rest-control groups (N = 16 apiece) were also employed, one at each of the four retention intervals for the two modalities. A number recognition task (Shepard & Teghtsoonian, 1961) filled all retention intervals exceeding 0 sec. Paralleling Goggin's (1966) procedure, experimental Ss were given single exposures of four-pair lists and were tested on the last two pairs of each list, which should have been subject to PI from the first two pairs. Thus, the first two pairs in each four-pair list defined List 1 (A'-C or C-D pairs), and the second two pairs defined List 2 (A-B pairs). Rest-control Ss learned a single two-pair list, equivalent to List 2 of experimental groups. The second pair was always tested before the first pair of List 2 for both experimental and control Ss. Scores from experimental and control list were

derived in three ways: (1) for number correct on the two pairs, an S's score being 0, 1, or 2 (AB scores); (2) for number correct on the last pair (first pair tested) in each two-pair list (A scores); and (3) for number correct on the first pair (second pair tested) in each two-pair list (B scores). An S's score could be 0 or 1 for both A and B scores. Interpretation of differences in results for A (three PI pairs) and B (two PI pairs, one RI pair) components of the total AB score focused primarily on the nonspecific RI present for B but not for A scores.

Acoustic similarity affected retention (high inferior to low AcS) but not learning for AB scores. Upon further analysis, however, the retention effect was found to be confined to B scores, suggesting augmentation of the AcS PI effect by nonspecific RI. For AB scores, Mo was a very powerful learning effect (aural superior to visual presentation) while it was ineffective in retention. However, the AB retention results were expecially misleading since Mo interacted with score such that aural was superior to visual performance with A scores, while the reverse was true of B scores. The inference made was that recall with visual imput was more susceptible to PI and recall with aural input was more susceptible to RI.

No increases in PI from 8 to 24 sec. were observed. Although Cycle-1 was superior to Cycle-3 recall, indicating the presence of cumulative PI in the latter cycle, there was no supportive evidence for Keppel's (1965) hypothesis that cumulative PI might obscure the effects of independent variables. Also the cycle x retention interval interaction of Goggin's (1966) experiment using the same number of test-cycles (three) was not evident in the present data. Finally, no divergence of STM and LTM results was indicated when learning and retention procedures were common for the two types of memory, and therefore Baddeley & Dale's (1966) hypothesis that AcS affects STM but not LTM failed to be accepted.

181. Holroyd, R.G., & Holroyd, Jean C. Associative clustering in a retroaction paradigm. *Journal of General Psychology*, 1961, 64, 101-104.

High school Ss heard and recalled lists of words in a clustering-retroaction design. The word-lists for one set of groups were composed of words which were high frequency associates of the category names and for the other set of groups were low frequency associates to the same names. One

group in each set had lists interpolated before recall which were composed of high frequency associates of new category names, and one group in each set had lists interpolated made up of low frequency associates to the same categories. Control groups were given an interpolated visual task.

The results show that high associative frequency lists yield better absolute recall and clustering than low frequency lists. Interpolation of either a high frequency or a low frequency list impaired absolute recall and clustering for high frequency original lists but did not affect these measures for low frequency original lists.

182. Homzie, M.J., & Weimer, J. Connotative similarity and paired-associate learning. *Journal of Verbal Learning and Verbal Behavior*, 1967, 6, 136-138.

Fifty-one Ss were divided into 3 groups; each group learned one of 3 lists of 8 word pairs (responses were available) prepared from an atlas of semantic profiles. A connotative list (C) comprised those word pairs which had similar mean values on one of three bipolar scales obtained from the atlas. An interference list (I) was composed of the same stimulus and response items as List C, but arranged so that dissimilar units were paired as associates. A mixed list (M) was formed by choosing half of the pairs from List C and the other half from List I. The results indicated that the learning of the 3 lists was directly related to the number of paired associates in each list that had common connotative meanings. It was concluded that connotative similarity of stimulus and response units facilitates the acquisition of paired-associates. The findings were replicated in an experiment in which the responses were not available.

183. Horowitz, L.M. Free recall and ordering of trigrams. *Journal of Experimental Psychology*, 1961, 62(1), 51-57.

This study was designed to examine the joint influence of intralist similarity and the nature of S's task on verbal learning. Two lists of 12 3-consonant trigrams were used. The trigrams of the high-similarity list contained only 4 different letters, while those of the low-similarity list contained 12 different letters. Two groups of Ss recalled as many syllables as they could after each of 10 presentations, while two other groups learned the order of the syllables but not the syllables themselves.

The results indicate the presence of an interaction between intralist similarity and the nature of S's task. High intralist similarity facilitates free recall early in learning, but this superiority is lost on later trials. Low intralist similarity, on the other hand, uniformly facilitates ordering. Since recall and intralist similarity have not been found to be systematically related when the method of serial anticipation was used, this interaction may be important in understanding the method of serial anticipation.

It was suggested that the method of this study might be applied to the study of paired-associate learning. The results also imply a way to maximize overall efficiency when S has to learn by the method of serial anticipation or by the method of paired-associates.

184. Horowitz, L.M. Associative matching and intralist similarity. *Psychological Reports*, 1962, 10, 751-757.

Recently Horowitz analyzed the serial anticipation method into two component tasks, response learning and ordering, and demonstrated that the effect of intralist similarity depends upon the particular nature of S's task. The present study was an attempt to extend this result to paired-associate learning by analyzing the paired-associate method into response learning and associative learning. The following procedure was used to study associative learning. S was presented with a series of stimulus-response pairs composed of a 3-consonant trigram and a high-frequency word. After each presentation of the series, S was supplied with a formboard, which contained all of the stimuli, and a packet of cards, which contained one response on each card. S placed each response card onto the formboard beside the stimulus with which it had been paired. Since S was not required to produce the response, the effect of response learning was minimized. With this procedure it was possible to demonstrate that high intralist similarity hinders associative learning. Other studies have demonstrated that high intralist similarity facilitates response learning early in learning. Thus, an interaction occurs between the effect of intralist similarity and the nature of S's task. Implications of this analysis were then discussed to help interpret several other recent findings.

185. Horowitz, L.M., & Larsen, Suzanne, R. Response interference in paired-associate learning. *Journal of Experimental Psychology*, 1963, 65(3), 225-232.

Response familiarization can facilitate or hinder subsequent paired-associate (PA) learning, but the critical task-variables have not been known. The present study suggests that items learned during familiarization may compete with the responses of the PA task. 80 Ss participated in a familiarization task and then learned English-Japanese word pairs by the PA or associative matching method. (In associative matching S does not produce the responses, so extralist responses cannot intrude.) Group I was familiarized with only relevant responses; Group II, with irrelevant but similar responses; Group III, with irrelevant, dissimilar responses; and Group IV had no familiarization. In associative matching the performance of Groups I and II was superior to that of Groups III and IV ($p < .001$). In PA learning the performance of Group I was facilitated while that of Group II was hindered ($p < .05$).

186. Horowitz, L.M., White, Margaret, A., & Atwood, D.W. Word fragments as aids to recall: The organization of a word. *Journal of Experimental Psychology*, 1968, 76(2), 219-226.

This paper discusses the organization of a single word. It shows that the beginning of a word is the best cue for eliciting that word; the middle is the poorest cue. S was shown a list of words 1 by 1 on a memory drum. (Some lists had 6-letter words and some had 9-letter words.) Then S saw fragment of the word, and he had to recall the entire word. The fragment was the beginning, or the middle, or the end of the word. 1 list, for example, contained the word "recognize," and S was shown the fragment "r e c -----," or "---ogn---," or "-----ize." A beginning fragment elicited the correct response most readily and with the shortest latency. The middle elicited the correct response least readily and with the longest latency. These results are also related to the issue of associative symmetry.

187. Houston, J.P., & Garskof, B.E. Clustering in recall as a function of associative overlap. *Psychological Reports*, 1963, 13, 699-701.

100 Ss were read a list of words which, while possessing minimal inter-item word association strength, varied in terms of the degree of inter-item associative overlap. An examination of immediate recall data revealed that clustering in recall was highly correlated with degree of associative overlap when word association strength was minimal.

188. Hudson, R.L. The associative basis of verbal organization: Some leads from a study on category clustering. *Psychonomic Science*, 1968, 11(10), 353. (a)

Clustering scores from an earlier study on short-term recall were correlated with on association test. The results indicated that specificity or generality of association is an important determinant of clustering. Several other correlations were presented which indicate some possible leads toward research supporting an associationistic interpretation of verbal organization.

189. Hudson, R.L. Category clustering as a function of level of information and number of stimulus presentations. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 1106-1122. (b)

An experiment was carried out to determine if the categorical relations in a group of words low in interitem associative strength will result in clustering. The main analysis used a 2 x 8 factorial design with 2 levels of information about the categorical relations of the words (either complete or none) and 8 numbers of stimulus presentations. The Ss were 160 college students. The conclusions were that the informed group clustered significantly more than the non-informed group.

190. Hyde, Y.D., & Jenkins, J.J. Differential effects of incidental tasks on the organization of recall of a list of highly associated words. *Journal of Experimental Psychology*, 1969, 82(3), 472-481.

In three experiments involving 17 groups, the amount and organization of recall of word lists varied with the type of incidental task performed by Ss during presentation of the list. All Ss heard a randomized list of high-strength primary word associates. When the incidental task required using the word as a semantic unit (rating the word as to its pleasantness), recall and organization were equivalent to those of a control group with no incidental task. When the incidental task involved the word as an object (checking for certain letters or estimating the number of letters in the word), recall and organization were greatly reduced. The effects were unaltered by incidental-plus-recall instructions, doubling presentation time, and presenting the list twice.

191. Jahnke, J.C. The Ranschburg effect. *Psychological Review*, 1969, 76(6) 592-605.

The Ranschburg Effect (RE) is an inhibitory effect on short-term recall observed when a stimulus string contains a repeated element. This article presents (a) a brief summary of recent research bearing on the RE, including an attempted identification of conditions associated with the effect, and (b) a consideration of the theoretical bases for the RE, including a new analysis of the effect and the results of two experiments designed as a first test of this notion.

192. Jahnke, J.C., & Melton, A.W. Acoustic similarity and the Ranschburg phenomenon. *American Psychological Association, Annual Meeting Proceedings*, 1968, 65-66.

Stimuli were strings of seven visual consonants presented for 1/2 sec. per consonant. Recall was oral, and if a letter could not be recalled in its proper position, S said "blank." Control strings contained no repeated letters; all others had repeated letters intraserial acoustic similarity has an important bearing on the RE, and it appears that at least two, and possibly three, mechanisms contribute to the effect.

193. Jenkins, J.J., Mink, W.D., & Russell, W.A. Associative clustering as a function of verbal association strength. *Psychological Reports*, 1958, 4, 127-136.

Each of 4 groups of students drawn from an introductory psychology course recalled a different word list comprised of stimulus and response words from the Kent-Rosanoff association test. The words were presented in random order. The average strength of the stimulus and response pairs (as measured by frequency of occurrence in word association norms) varied systematically from list to list. All groups showed a significant tendency to recall the Kent-Rosanoff pairs together in the stimulus-response sequence. Further, the average amount of such forward associative clustering was closely related to the average free association strength of the pairs in each list. All groups also showed a significant tendency to recall the pairs together in the reverse or response-stimulus sequence. Norms for reverse association were collected and it was found that the average reverse associative clustering was related (with one reversal) to the average reverse strength in free association. The recall protocols were rescored by dividing the number of forward and reverse clusters by the opportunities for forward and reverse clustering. These data, which confirmed the findings of the

earlier analysis, showed that forward and reverse data may be reviewed as points on a continuous function. The evidence suggested that the variability in the results might be attributed to group differences in commonality. The results are interpreted as demonstrating that associative clustering in recall as an increasing monotonic function of the free association strength of the pairs being recalled.

194. Johnson, N.F. The influence of associations between elements of structured verbal responses. *Journal of Verbal Learning and Verbal Behavior*, 1966, 5, 369-374.

An operational model was proposed for the generation of sentences. The model was based on the immediate constituent structure of sentences, and it was suggested that sentences are generated by successive decoding of high-order encoding units into their constituents. One of the implications of the model is that if Ss use associations in generating sentences they are probably between the hypothetical decoding operations rather than the responses themselves. The implication was tested by establishment of an adjective-noun (A-N) and a noun-verb (N-V) association prior to learning sentences which incorporated these word pairs. The model suggests that the operations involved in generating the adjective and noun are adjacent while those generating the noun and verb are not. Therefore, it was predicted that during the sentence learning the A-N transition should be facilitated by the prior association while the N-V transition should not. The results confirmed the hypothesis.

195. Johnson, W.L., & Chamberlin, Camille, M. Semantic and acoustic similarity and their effects on short-term retention. *Psychonomic Science*, 1970, 19(4), 217-218.

Ss were given five-word sequences which they were asked to recall after three intervals of interpolated activity (5 sec., 20 sec., and 40 sec.). The sequences were of three types: acoustically similar, semantically similar, or control. There was a significant interaction between retention interval and type of similarity in which only the acoustic effect was significant at 5 sec. and only the semantic effect at 40 sec. These findings seem to resolve some previous discrepancies and are viewed as being consistent with Waugh & Norman's (1965) distinction between PA and SM. It is suggested that PM is primarily acoustic, while SM is primarily semantic.

196. Joinson, Peggy, A., & Runquist, W.N. Effects of intralist stimulus similarity and degree of learning on forgetting. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 554-559.

Retention of lists varying in intralist stimulus similarity was measured after 1 week following learning to one of three levels. The results showed no effect similarity on forgetting at low or high criteria, but less forgetting of the high-similarity list at the medium criterion. There was some evidence of maximum forgetting at the moderate criterion in the low-similarity list. The results are not explainable by differential recovery of interference, but are probably due to partial grouping of items in the high-similarity list.

197. Jung, J. Two stages of paired-associate learning as a function of intralist-response similarity (IRS) and response meaningfulness (M). *Journal of Experimental Psychology*, 1965, 70(4), 371-378.

Separate studies show that high intralist-response similarity (IRS) aid the response-learning stage (Underwood, Runquist, & Schulz, 1959) and hinders the associative-learning stage (Horowitz, 1962) of paired-associate learning. Neither study examined both stages simultaneously as does the present study. In addition, effects of response meaningfulness (M) on each stage are assessed. 2 levels of each variable were studied in Experiment I. Response learning was superior to associative learning on early trials but only with high IRS; little difference between the 2 types of learning resulted with low IRS. Experiment II replicated only the high-M conditions of Experiment I using separate rather than the same groups of Ss for each type of learning. Results obtained with the 2 methods were highly similar.

198. Kagan, J.M. Free recall of categorized words as a function of delay, set and word association. *Dissertation Abstracts*, 1966, 27, 626-B.

A list of 63 words, comprised of six categories at each of three IAS levels, was presented to separate groups of Ss for free recall after a delay of 0, 5, 10, 20, or 40 minutes. The Ss were 375 men and women college students. One-third of the Ss were given an incidental learning set and one-third were given standard free-recall instructions. The third condition, called encoding, informed Ss that the words they would have to remember were in categories and that they might find this useful in recall.

The results showed that longer delay periods yielded fewer categories represented in recall but no significant drop in the number of words recalled per category. This finding was predicted on the basis of a two-factor theory of recall stating that recall is determined by memory of a few words and free associations to these.

The number of words recalled per category did not remain constant over instructions. Incidental learners recalled significantly fewer words at all IAS levels. This indicated that optimal retrieval of categorized words, even of high IAS, must be predicated on intentional learner actively engaged in making discriminative responses to the stimuli during learning. Detection of categorization may also have been absent or weak in incidental learners.

There was generally little difference between standard intentional learners and encoders. However encoders exhibited more category label intrusions and more total recall, words per category and clustering at low IAS. These results were interpreted as indicating that intentional Ss encode in most instances without being told to do so. Only at low IAS does foreknowledge of categorization yield any advantage in recall.

High IAS yielded most words recalled per category, most clustering and fewest intrusions. It also yielded significantly more categories represented in recall even though the correlation between a category's IAS and its frequency of representation in recall was not significant ($r = .08$). The notion of associative convergence or priming was used to explain these data, as well as the correlation between IAS and words recalled per category ($r = .78$).

This study showed the effects of availability (of memory traces) on amount of recall through poorer category recall after delays of 20 and 40 minutes. The effects of intra-category word association were demonstrated by absence of forgetting for words recalled per category, especially at high IAS, and by the main effects of IAS on all recall and intrusion data. The importance of discriminative responses during list presentation were highlighted through the results based on instructions where the superiority of intentional over incidental learners on all recall measures and even relevant intrusions led to the conclusion that incidental Ss do not make the requisite discriminatory responses for optimal recall of meaningful and organized material.

199. Kanak, J.N., Cole, L.E., & Thornton, J.W. Inter-item manipulations of implicit associative responses in verbal-discrimination learning. *Psychonomic Science*, 1970, 18(6), 359-361.

Two experiments were performed to test predictions from frequency theory regarding the role of implicit associative responses (IARs) in verbal-discrimination learning. Although list content was demonstrated to limit generalization, a list employing associatively related right (R) items and unrelated wrong (W) items was consistently found to be most difficult, while lists composed of associatively related wrong (W) items tended to be learned most readily. These results fail to replicate the findings of Ekstrand, Wallace, & Underwood (1966) and are inconsistent with the frequency theory. Methodological variables having possible implications for the obtained results were suggested for further investigation.

200. Kaplan, G.A., Yonas, A., & Shurcliff, A. Visual and acoustic confusability in a visual search task. *Perception and Psychophysics*, 1966, 1, 172-174.

Visual and acoustic confusability between a target item and background items was varied in a visual search task. Visual confusability was a highly significant source of difficulty while acoustic confusability had no effect. The results do not seem to be interpretable within a theory which assumes compulsory auditory encoding of visual information.

201. Kasschau, R.A., & Pollio, H.R. Response transfer mediated by meaningfully similar and associated stimuli using a separate-list design. *Journal of Experimental Psychology*, 1967, 74(1), 146-148.

Ryan's (1960) comparison of verbal response transfer mediated by meaningfully similar and associated stimular and associated stimuli in a mixed-list design was repeated using separate lists for each type of mediational relationship. On most measures, meaningfully similar stimuli were found to be indistinguishable from associatively related stimuli in mediating response transfer. In contrast to Ryan, both types of interlist relations facilitated transfer more than unrelated control lists. These results were interpreted to mean that which set of stimulus relations Ss utilize in mediating transfer depends upon particular task constraints.

202. Katz, J.J., & Fodor, J.A. The structure of a semantic theory. *Language*, 1963, 39, 170-210.

The present paper approaches the problem of characterizing the form of semantic theories by describing the structure of a semantic theory of English. There can be little doubt but that the results achieved will apply directly to semantic theories of languages closely related to English. The question of their applicability to semantic theories of more distant languages will be left for subsequent investigations to explore. Nevertheless, the present investigation will provide results that can be applied to semantic theories of languages unrelated to English and suggestions about how to proceed with the construction of such theories.

203. Kausler, D.H., & Kamichoff, N.C. Free recall of homographs and their primary associates. *Journal of Verbal Learning and Verbal Behavior*, 1970, 9, 79-83.

Free recall of homographs and their primary associates was investigated under various priming conditions. Priming consisted of presenting distracting items simultaneously with to-be-remembered words during the study phases of free recall trials. When the distracting items were words related to the alternate meanings of the homographs, that is, meanings unrelated to the meanings inferred from the primary associates, both clustering between homographs and their primary associates and recall across trials were markedly reduced, relative to control conditions receiving neutral items (words or digits) as distractors.

204. Kausler, D.H., & Olson, R.D. Homonyms as items in verbal discrimination learning and transfer. *Journal of Experimental Psychology*, 1969, 82(1), 136-142.

In Exp. I, verbal discrimination (VD) lists composed of homonym word pairs as wrong (W) and right (R) items were more difficult to learn that a control list containing no homonym word pairs. Moreover, an intrapair W-R homonym condition was less difficult to learn than an interpair W-R condition. Free recall measures of W and R items indicated that the intrapair and interpair conditions differed primarily in the process employed to "tag and collapse" pairs of items for use in the recognition of R items during VD practice. In Exp. II, the W_1-R_1, W_2-R_1' VD transfer paradigm was employed with homonym words providing the R_1-R_1' relationship. Positive transfer, relative to the W_1-R_1, W_2-R_2 control, was found but only when Ss were informed that List 2 contained items similar to List 1 items.

205. Keller, D., & Glanzer, M. Recognition of words and homonyms as a function of amount of preexposure. *Journal of Experimental Psychology*, 1969, 80(1), 160-164.

Two experiments determined the effect of preexposure of words on their recognition thresholds and on the thresholds of their homonyms. The first experiment, a replication of Neisser's (1954) study, yielded results similar to his. The second experiment varied the amount of preexposure of the words and homonyms and indicated systematic and different effects of increasing preexposure. Preexposure of a word made it easier to recognize. Minimal preexposure of a word also made its homonym easier to recognize. Increasing preexposure, however, lowered the probability of recognition of the homonym, while increasing the probability of recognition of the word.

206. Kendler, H.H., Kendler, Tracy, S., & Marken, R.S. Stimulus control and memory loss in reversal shift behavior of college students. *Journal of Experimental Psychology*, 1970, 83(1), 84-88.

College students were trained to discriminate between words from two conceptual categories. After Ss learned to sort the words in a conceptually consistent fashion, a reversal shift was instituted. For one group, both preshift and postshift training occurred with the same words. For the second group, new words from the identical conceptual categories were substituted during postshift training. Both groups executed a reversal shift at approximately the same speed, thus suggesting that the locus of stimulus control of postshift behavior resided in the cue from the mediated response acquired during preshift training. Evidence was also obtained that indicated that when Ss sort words into conceptual categories, the memory of the word per se is reduced.

207. Keppel, G. Verbal learning in children. *Psychological Bulletin*, 1964, 61(1), 63-80.

The major purpose of the review was to examine the validity of the assumption that the laws of verbal learning obtained on the college student will hold reasonably well for younger populations of Ss. Various areas of verbal learning, such as free learning, paired-associate learning, serial learning, transfer, retention, and retroactive-proactive inhibition, were reviewed in order to determine the extent to which the general findings of these areas, based on experiments in which the college student has served as S, have been investigated and replicated with children as Ss. The literature on children's verbal learning revealed a reasonable correspondence in the effective variables reported and in the relationships that have been identified with adult Ss.

208. Kimble, G.A. Mediating associations. *Journal of Experimental Psychology*, 1968, 76(2), 263-266.

In 2 different experiments, lists of 324 words were read to over 500 Ss who were instructed to indicate whether they thought each word had previously appeared in the list. Each list contained some new words that were known associates of words that had appeared earlier in the list. Ss in both experiments showed a highly significant ($t > 15.0$) tendency falsely to report these associates as old. In Experiment I the associations were primarily coordinate associations. In Experiment II they represented sense impressions. These results confirm the existence of a phenomenon reported by Underwood. Underwood's mediational interpretation of the effect also seems appropriate but questions remain as to the nature of the mediating response.

209. King, F.J., Reid, I., & Roberts, D.M. Free recall of intralist items as a function of serial position, association value and comceptualization. *Psychonomic Science*, 1966, 4(8), 311-312.

Eight lists were developed each consisting of four words with high association values and four words with low association values. Words were alternated within the lists on either a high, low, high, low or a low, high, low, high scheme. Some lists had high intraiist association value (a common associate for the words in the list) while others did not. The different alternation patterns modified the normal serial position curves. The presence of a common associate did not facilitate recall.

210. Kintsch, W. Recognition and free recall of organized lists. *Journal of Experimental Psychology*, 1968, 78(3), 481-487.

2 experiments were performed which show that orgainization of the learning material facilitates recall, but has little effect upon recognition performance. In the 1st experiment Ss learned lists of 40 words, 10 each from 4 conceptual categories or unstructured control lists. In the 2nd experiment the learning material consisted of CVCs which were constructed so that letter combinations were highly predictable in the control groups. Intralist similarity was also varied by using either 5 or 10 different consonants to construct each set of CVCs. High intra-list similarity depressed performance for both recall and recognition, but did not interact with list structure. The differential effect of organization upon recall and recognition was interpreted as supporting a 2-process theory of recall and recognition.

211. Kintsch, W., & Buschke, H. Homophones and synonyms in short-term memory. *Journal of Experimental Psychology*, 1969, 80(3), 403-407.

Differential effects of acoustic and semantic similarity on primary and secondary memory are shown by analysis of short-term retention for sequences of 16 words containing either homophone pairs, synonym pairs, or unrelated words. After presentation of each sequence, one of the words in the sequence was given as a probe for S to respond with the word that followed the probe in the sequence. Recall of early words in the lists was used to estimate the secondary memory component of short-term retention. Secondary memory was strongly decreased by semantic similarity. Recall of the most recent words in the lists provided a basis for estimation of primary memory. Primary memory was unaffected by semantic similarity, but was decreased significantly by acoustic similarity.

212. Kintsch, W., & Kintsch, Eileen. Interlingual interference and memory processes. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 16-19.

Bilingual Ss learned eight-item paired-associate lists with four English and four German words as stimuli and the digits 1-8 as responses. Four translated word pairs were used as stimulus terms for Experimental lists and unrelated words were used for Control lists. Interlingual interference was observed, in that the Experimental lists were harder to learn than the Control lists. It was concluded that the semantic relationships between words in different languages influence tasks involving secondary memory. No interlingual interference was obtained in a second learning situation which depended mostly upon primary memory.

213. Klein, G.S. Semantic power measured through the interference of words with color-naming. *American Journal of Psychology*, 1964, 77, 576-588.

Two experiments investigated the basis of interference in the Jaensch-Stroop phenomenon: the relative difficulty of naming colors when the actual colors are incongruently combined with the words signifying the colors, e.g., the word 'red' printed in the color 'yellow,' etc.

(1) The first experiment compared color-naming speeds when the same four colors (red, green, yellow, and blue) appeared in six different verbal contexts. Ninety Ss were distributed

among the six conditions, 15 to each group. Interference of the words with color-naming was least when the verbal text consisted of nonsense-syllables, increased somewhat when the verbal context contained actual though rare words, rose markedly with common words, and still more with words closely related to the color-responses in their meaning or in their direct reference to color; it was greatest of all in the standard condition (where the actual words were 'red,' 'green,' 'yellow,' and 'blue'). Thus, amount of reading delay depends on the relatedness of the vocal components of the word, the word's meaningfulness generally, and the color-specific meanings of the word, to the relevant color-response.

(2) If delay in color-naming is produced by the necessity of holding back a competing response, it should disappear when Ss are allowed to say aloud both the word and the color-name of a word-color unit. In a second experiment, two conditions of double-response were studied: 20 Ss reading aloud word-then-color of a color-word unit in that order, and 20 Ss reading each unit in the color-then-word order. When Ss are allowed to say aloud both the word and the color in that order, color-naming is markedly improved. On the other hand, no benefit to color-naming is gained by reading aloud first the color and then the word of a word-color unit; it is, in fact, significantly worse in this condition.

(3) Two main determinants of the interference-effect and of the color-naming delay were proposed: (a) the attensive power of a word--i.e., the word's capacity, when the word is present in the color-context, to bring about a rise in activation of the vocal motor-component of the word's structure; (b) compensatory restimulation from the relevant part of the stimulus-field (in this case, color) which makes possible the release of the relevant motor-response and its domination of the vocal output-channel.

214. Koeppel, J.C. Intralist similarity, internal structure, and free recall. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 882-806.

This study was designed to investigate free-recall learning of trigrams as a function of intralist similarity and form of structure. Similarity refers to the extent to which stimuli on the list share the same letters; form of structure refers to the contigenices between the letters which occur in the subset of trigrams. With similarity and form used to generate items, three different lists emerged: high similarity, good form (G); high similarity, poor form (P); and low similarity, indeterminate form (L). The results indicate that high-similarity items are learned more readily than low-similarity items (L) only if the high-similarity items also have good form (G); when high-similarity items have poor form (P), the L stimuli are more readily acquired. Theoretically, Underwood's stage-analysis position is supported when performance on G trigrams is compared to that on L items. Garner's prediction, that G items will be learned more readily than P items, is also supported.

215. Koeppel, J.C., Beecroft, R.S. The conceptual similarity effect in free recall. *Psychomonic Science*, 1967, 9(4), 213-214.

A sizable facilitative effect of conceptual similarity on free recall was obtained with a mixed-list technique. Subsequent to the first recall, related and unrelated words were learned at the same rate.

216. Kolers, P.A. Interlingual facilitation of short-term memory. *Journal of Verbal Learning and Verbal Behavior*, 1966, 5, 314-319. (a)

The probability of recalling a word from a long list of unconnected words increases monotonically with its frequency of occurrence. This facilitating effect of repetition upon recall is found to occur interlingually. The probability of recalling a word when it and its translation are presented n/2 times in each of a bilingual's two languages is approximately equal to its unilingual presentation n times. Since the words in the two languages are usually phonetically and visually distinct, it appears to be their conceptual identity that permits the facilitation.

217. Kolers, P.A. Reading and talking bilingually. *Journal of Psychology*, 1966, 79(3), 357-376. (b)

Bilingual Ss were tested in several linguistic tasks with different kinds of material. Passages were prepared in unilingual, alternating, and mixed-language forms. The Ss were tested for comprehension, for ability to read aloud, to make precis, and to speak freely in these forms. Comprehension was found to be unaffected by the linguistic form of a message, but the other tasks showed decrements of the order of 20-40% when mixed text was articulated. The equivalence for comprehension of the form of the text, the occurrence of unique kinds of error in reading, and the problems of memory-search in generation were taken as evidence that the encoding and decoding of language are not symmetrical operations. The kinds of error made in reading aloud demonstrate, in turn, that reading cannot be described accurately only in terms of grapheme-phoneme translations.

218. Kolers, P.A. Bilingualism and bicodalism. *Language and Speech*, 1965, 8, 122-126.

Bilingual subjects were presented with long lists of words which they subsequently tried to recall. On some lists the words appeared in red or in black; on other lists, they appeared in French or in English. On mixed lists, words appeared both in red and in black, or both in French and in English, but no word appeared in two colours or was translated. The main finding was that only about half as many words were recalled from the list with respect to colour (arbitrary code) as were recalled from the linguistically mixed list. A distinction is thus made experimentally between arbitrary and well-formed coding systems, as they affect short-term memory.

219. Korn, S.J. "Relatedness" and semantic generalization. *Dissertation Abstracts*, 1966-B, 1305-1306.

The purpose of this study was to discover whether magnitude of generalization is dependent on subjects' rating of the degree of "relatedness" between the conditioned and generalization test words, rather than on their formal semantic relationship. Two hundred college students were administered a Word Rating Scale in which pairs of words were rated in terms of the degree to which the words were related or "had something to do with one another." The words subsequently utilized as conditioned and generalization stimuli were included as word pairs in this scale.

Nine groups, with ten subjects each, were selected on the basis of their ratings on the scale and were deployed in a three by three factorial design. Each of the two main variables, semantic category and rating of relatedness, had three subconditions. The three semantic categories were synonym, antonym, and homophone, and the three ratings were high, medium and low degree of relatedness. An automobile horn was the unconditioned stimulus and the galvanic skin response (resistance change) was used as the response measure. The conditioned stimulus was the word "allow." The word "concur" was used as the generalization test word for the High, Medium, and Low Synonym groups, and the words "reject" and "avow" were used for each of the three Antonym and Homophone groups, respectively. A discrimination conditioning paradigm was employed, and a test trial consisted of the presentation of a conditioning or generalization stimulus and a neutral stimulus. The measure of the magnitude of the response for each of the four acquisition and five generalization test trials was the difference between the resistance change to the conditioned or generalization stimulus and a contiguous neutral stimulus.

The only source of variance in the analysis of the generalization data that yielded a significant F ratio was the "between ratings" factor. In each of the three semantic categories, synonoyms, antonyms, and homophones, mean generalization was greatest to the "high" related word and was smallest to the "low" related word. No differences in magnitude of generalization were found among the three semantic categories exclusive of difference attributable to ratings of relatedness. No significant interactive effects were found.

These results support the conclusion that factors other than formal semantic category are involved in semantic generalization and that phenomenal relatedness is a significant, although too frequently ignored, variable. The results and implications of this study were related to alternative theoretical suggestions and the mediation hypothesis was elaborated in terms of possible intra-verbal response hierarchies that can account for the data obtained.

220. Kuennapas, T. Visual memory of capital letters: Multidimensional ratio scaling and multidimensional similarity. *Perceptual and Motor Skills*, 1967, 25, 345-350.

The similarity of 9 capital letters, as judged on the basis of visual memory, was studied by direct multidimensional ratio scaling and by the method of similarity analysis. Three factors were isolated which were exactly the same as previously found in perception of these capitals and with nearly identical loadings.

221. Kurcz, I. Semantic and phonetographic generalization of a voluntary response. *Journal of Verbal Learning and Verbal Behavior*, 1964, 3, 261-268.

The purpose of the experiments reported here was to determine whether the phenomena demonstrated with semantic conditioning of involuntary responses could be similarly demonstrated when the response involved was voluntary. A key pressing response was employed. The S was instructed to respond to certain words and not to any others as words were shown on a screen in front of him. After 12 trials in which reinforced words and neutrals were presented to S, generalization words and new neutral words were introduced for two trials. The first six experiments tested for generalization of the key-pressing response (as measured by miographic recordings taken from muscles active during overt key-pressing) to logically related words and phonetographically similar words. Both classes of words were found to yield significant generalization indices. The generalization to phonetographically similar words appeared to be largely a matter of the proportion of letter overlap between reinforced words and generalization words. The semantic generalization appeared not to be a function of the logical classes employed but rather seem to be related to the strength of association between the words in the pairs.

A free-association test with continuous responding confirmed that associative strength as measured in free association was significantly related to the percentage of generalization responses. Association from the reinforced word to the generalization word correlated +0.35, the reverse association correlated +0.17, and the mean of both associative strengths correlated +0.50 with the amount of generalized responding to a particular test word.

Further experiments using the terms making up compound words found strong bidirectional generalization, as did experiments in which the associations between pairs of words were experimentally strengthened via paired-associate learning prior to the generalization experiment.

The relevance of the findings to the issue of associative direction and amount of generalization was discussed. The present experiments argue for some contribution from associations in both directions (that is, from the reinforced word to the generalization word and vice versa). It was concluded that the technique presented here is effective and productive for the study of both phonetographic and semantic generalization.

222. L'Abate, L. Recognition of paired trigrams as a function of associative value and associative strength. *Science*, 1960, 131, 984-985.

The accuracy of visual recognition of tachistoscopically presented paired nonsense trigrams was shown to vary directly with the associative value and associative strength. Parallel results were previously reported for meaningful verbal material. It is argued that the same perceptual processes underlie the learning of nonsense and of meaningful material.

223. Lachman, R. Comment on Rosenberg's reply to Lachman, Dumas, and Guzy. *Psychonomic Science*, 1966, 5(6), 250.

The complexity of natural language is such that when a variable is experimentally manipulated in the context of syntactic discourse, other variables are almost inevitably manipulated concomitantly. Thus, when Rosenberg inserted normatively high association words into an English paragraph, he modified the phrase content and very likely changed the transitional probabilities of the phrases in that paragraph.

An ideal design would involve orthogonal variation of word association level and natural language frequency of phrases in connected discourse. Since phrase frequencies are presently unavilable, Lachman, Dumas, and Guzy randomized the order of context words and thereby destroyed the phrase structure along with all syntax. The Lachman et al results demonstrate that word association and syntactical context interact to enhance recall, most likely because under these joint conditions the paragraph is loaded with high frequency phrases, clinches.

Rosenberg, in his reply, makes two main points. His first one is that the control groups were inappropriate as Ss had only 63 sec. to learn 149 unordered words. In point of fact, 63 sec. was sufficient for the high association control condition to show superior retention for all dependent variables employed except stimulus words (see Table 1 in Lachman et al). His final point was that Lachman et al failed to find a significant main effect for recall of stimulus words and "the reliability of this finding is questionable." It is indeed questionable for, as Table 1 in Lachman et al shows, there is a reversal in the recall of stimulus words between the syntactical and nonsyntactial condition. The nonsignificant main effect, thus, is due to a very strong interaction.

224. Lachman, R., Dumas, J.S., & Guzy, L.T. Joint effects of word association and approximation to English. *Psychonomic Science*, 1966, 5(4), 145-146.

Four lexical training lists were administered in a 2 by 2 factorial experiment. The lists were constructed to reflect two levels of approximation to English (a nonsyntactical word order and an English paragraph) and two levels of word association. A significant interaction was obtained for each of several retention measures employed. The data support the view that high frequency associates, when incorporated into natural language discourse, load the passage with high frequency phrases (clichés) and make a high approximation to English still higher.

225. Lambert, W.E., Ignatow, Maria, & Krauthamer, M. Bilingual organization in free recall. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 207-214.

Two groups of Ss, one bilingual in English and French, the other in English and Russian, were tested individaully and presented different types of 40-item lists of common words with instructions for free recall. Some were Category list--those with four sets of 10 words each concerned with a distinctive class of events--and some were No-Category list--those with 40 items selected so as not to suggest distinctive semantic categories. For the No-Category case, one list was in English, one in French (or Russian) and one "mixed," i.e., including items from both languages. For the Category case, one list was in English, one in the other language, one mixed but Concordant, i.e., particular semantic categories were in one language while other categories were in the other language, and one mixed so that language and semantic content were Discordant, i.e., within a category items were drawn from both languages. Attention was given to the number of items correctly recalled, the types of errors made, the extent of both category and language clustering.

Various results suggest that organization according to semantic categories is a more useful schema than is language for bilinguals. However, the bilingual nature of the mixed lists does not disrupt recall in the No-Category condition although it can be a disruption when demands for reorganization are strong, as in the case in the Category conditions. Nevertheless, the bilingual still profits from the organizational possibilities of the Category lists, even in the discordant case, indicating that an associationistic interpretation of category clustering is insufficient.

226. Laughery, K.R., & Fell, J.C. Subject preferences and the nature of information stored in short-term memory. *Journal of Experimental Psychology*, 1969, 82(2), 193-197.

A two-part experiment was carried out to explore performance on a memory-span task as a function of the presentation mode that Ss prefer. The first part of the experiment used a memory-span procedure involving eight-letter sequences where the presentation mode (visual or auditory) was randomly mixed. In the second task, Ss were exposed to auditory and visual five-letter sequences simultaneously and could record either the auditory or visual sequence--establishing a perference. The compatibility between mode preference in the second task and relative performance on visual and auditory items in the first task showed that Ss perform better on auditory items regardless of their mode preference. This result is interpreted as support for the notion that short-term memory is basically an auditory storage system.

227. Laughery, K.R., & Harris, G.J. Visual and auditory intrusion errors in short-term memory. *Journal of Experimental Psychology*, 1970, 83(1), 101-106.

Two experiments explored intrusion errors in a modified memory-span task. The Ss were presented sequences of eight letters. Presentation rate (.3, .5, and 2.0 sec/item) and presentation mode (visual and auditory) were manipulated between Ss. After each sequence, Ss turned over a card with eight letters on it and compared it to the just-presented sequence. Where differences occurred, Ss wrote in the correct item(s). In Exp. I, these E intrusions were visually similar to or distinct from the correct item. In Exp. II, the intrusions were auditorily similar or distinct. Auditorily similar intrusions yielded more failures to detect the errors, but visual similarity had no effect. Analyses of S intrusions, taking into account the a priori probabilities for each S intrusion being similar or distinct, yielded evidence for visual as well as for auditory intrusions.

228. Laughery, K.R., & Pinkus, A.L. Short-term memory: Effects of acoustic similarity, presentation rate and presentation mode. *Psychonomic Science*, 1966, 6(6), 285-286.

The effects of four variables on short-term memory were stuided: Presentation Rate (20, 60, or 180 items/min.), Presentation Mode (visual or auditory), Acoustic Similarity (High, BCDEGPTVZ or Low, HJLOQRWXY), and Length of Sequence (6 or 8 items). Performance varied inversely with the Length

of Sequence and Acoustic Similarity and directly with Presentation Rate. A significant Presentation Rate by Presentation Mode interaction was explained on the basis of less available time for rehearsal at the fast presentation rate due to the time required for the implicit translation from visual input to the storage of auditory cues.

229. Laurence, Mary, W. A developmental look at the usefulness of list categorization as an aid to free recall. *Canadian Journal of Psychology*, 1967, 21(2), 153-165.

Sixty literate Ss (12 in each of five age groups) and 24 preschool Ss (12 in each of two groups) were tested for immediate free recall of four lists differing in degree of concept category relatedness in two separate but related experiments. Two lists wherein all words belonged to the same concept category (HiC) and two lists of "unrelated" words (LoC) were presented using a Latin square design. The first hypothesis that preschool children would show minimal difference in their recall of HiC and LoC lists was only partly upheld, and hence only equivocal support for Piaget's theory related to cognitive development at the preschool level is forthcoming. The second hypothesis that elderly adults would show significantly greater disparity between mean recall levels of HiC and LoC lists than would young adults was upheld. This finding was evaluated in terms of theories concerning growing inflexibility in the intellectual processes of the elderly.

230. Lauro, L.P. Recall of nouns varying in clustering tendency by normals and schizophrenics. *Dissertation Abstracts*, 1963, 24, 836.

The present study is an exploration of the differences between normals and schizophrenics in their clustering tendency. Clustering is "the occurrence of sequences of related words as they appear in the recall of items presented for learning in random order." Its theoretical significance lies in its representing a type of organization characteristic of higher-order mediating processes.

The schizophrenic group comprised 30 male patients at the Manhattan Veterans Administration Hospital who had had at least two previous hospitalizations and who carried a diagnosis of schizophrenia. Normal subjects were drawn from among minor surgery patients at the hospital who had no psychatric history. They were matched to schizophrenic subjects according to score on the Wide Range Vocabulary Test.

Potential subjects who had scores of less than 50 on the Vocabulary Test and/or could not repeat six digits on one out of two trials were screened out.

Two recall lists of 40 words each drawn from tables of taxonomic norms were employed. They consisted of words from four categories arranged in random order. The first list was of high and the second of low clustering tendency. These lists were presented to Ss under standard conditions via tape recorder and earphones. Ss wrote the words on cards as they recalled them so that the previously recalled word was always in view. After each list presentation and recall, Ss were asked to fill out semantic-differential ratings on each of the words in the list plus any additional words they had "imported" during recall.

The Ratio of Repetition, a measure of degree of clustering, was computed for all recall lists. Differences in semantic differential ratings between each pair of words in the order of recall were computed. Imports were tabulated according to whether they were relevant (fit into the taxonomic categories) or irrelevant.

The easy clustering list showed no significant differences between normals and schizophrenics. However, in the recall of the difficult clustering list, schizophrenics tended to have a lower Ratio of Repetition and to import more irrelevant words than did normals.

These findings are consistent with the views that clustering reflects higher order coding and mediating processes (Bousfield, 1953; Cofer, 1959), that schizophrenic thought lacks a unity occasioned by central objective ideas (Werner, 1957) and that schizophrenics tend to give up common symbols and revert to paleosymbols.

A suggested reinterpretation of clustering as occurring on different levels, associative and taxonomic was offered. It was also suggested that it would be fruitful to determine what relationships obtain between clustering and other measures of schizophrenic dysfunction.

231. Lerner, R.M. Semantic conditioning and generalization. *Psychological Reports*, 1968, 22, 1257-1260.

One female college freshman, serving as S, was conditioned to salivate to a list of words, and generalization to synonym-related and homonym-related word lists was then studied. No significant difference was found between generalization to the

word lists of synonyms and homonyms; both lists exerted the same control over behavior. E concluded that these results support the notion that reliable semantic generalization gradients cannot be demonstrated when the data of individual Ss are considered. Some shortcomings of semantic conditioning and generalization research are discussed.

232. Levy, C.M., & Gentner, F.C. Learning rhymed and unrhymed paired associates. *Psychological Reports*, 1967, 20, 222.

Three lists of one-syllable word stimuli-nonsense syllable responses were prepared. The rhymed (R) list contained pairs whose final vowel and consonant sounds were similar, e.g., son-dun, was-tuz. The consonance (C) and unrhymed (U) lists contained the same materials as the R list but in different pairings; in the former, the final consonant sound was common within a pair, e.g., son-wen, was-bez, and in the latter, no letters were shared by a stimulus-response pair, e.g., son-ked, was-dol.

During pretraining, 45 Ss, meeting a course requirement in introductory psychology, were presented the response members at a 4-sec. rate on a Lafayette memory drum until they could pronounce the words of four consecutive trials in the manner prescribed by E. Ss were unsystematically assigned a training list. During training, one list was presented at a 2:2 rate, and S was required to pronounce the stimulus and anticipate the response by pronouncing and spelling it. Training ended when S reached a criterion of one errorless trial.

Mean numbers of trials to reach criterion during training were 11.54, 20.74, and 25.00 for Lists R, C, and U, respectively. An analysis of variance indicated a significant Lists effect ($F = 7.94$, $df = 2/42$, $MS. = 57.95$, $p < .01$). A Ducan Multiple-range Test showed that the R-C and R-U means differed significantly ($p < .01$), but the C-U mean difference was nonsignificant. Thus, the cue of auditory similarity of the final consonant produced no facilitation, but the combination of common final vowel and consonant sounds, which may be inherent to what is ordinarily meant by rhyme, was reliable. McGeoch (1942) has suggested that one of the reasons poetry is learned more readily than prose is the difference in rhyme. The present findings imply that a combination of similar phonemes, quite apart from similarity of the letters or characters involved, is also quite important.

233. Levy, Betty Ann, & Murdock, B.B., Jr. The effects of delayed auditory feedback and intralist similarity in short-term memory. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 887-894.

Three studies are reported in which Ss heard items under delayed or immediate auditory feedback (DAF, IAF). In Exp. I associatively similar lists were used in an attempt to limit the use of associative cues, thus forcing the S to rely on acoustic cues. The hypothesized decrement at recall under DAF as compared to IAF was not found. In Exp. II acoustically similar lists of words were used with two presentation rates. Acoustic similarity had an adverse effect on recall in Primary Memory. Presentation rate was an important variable only in Secondary Memory. Experiment III separated visual and acoustic similarity by using letters. Again the acoustic decrement at recall was found. Visual similarity had no effect. A DAF effect was not found in Exp. II or III. The results are discussed in terms of the loss of articulatory cues being the crucial factor determining the acoustic effect. Further, criterion shifts rather than differential decay may account for the effect of acoustic similarity.

234. Light, Leah, L., & Carter-Sobell, Linda. Effects of changed semantic context on recognition memory. *Journal of Verbal Learning and Verbal Behavior*, 1970, 9, 1-11.

The effects of semantic context on noun recognition were investigated in three experiments. Experiment I examined the effect of changed semantic interpretation at recognition by pairing nouns with the same adjectives for study and recognition or by pairing nouns with adjectives biasing one semantic interpretation for study and with adjectives biasing different semantic interpretations for recognition. Experiment II replicated Experiment I and included a noun-only recognition condition to control for the effects of disrupting the unity of adjective-noun pairs at recognition. In Experiment III the effect of adjective change per se was determined by including a condition in which the adjectives accompanying nouns at recognition differed from the study adjectives but biased the same semantic interpretations of the nouns. Changing the semantic reading of nouns at recognition depressed performance in all three experiments. The need for a model of recognition memory including both retrieval and decision processes was discussed.

235. Lingon, Elizabeth. The effects of similarity of very-short-term memory under conditions of maximal information processing demands. Unpublished doctorial dissertation, University of Michigan, 1968.

The purpose of this dissertation was to assess the role of similarity in very-short-term memory within an experimental situation which assures perception but permits little or no rehearsal of the items to be recalled. Assessing the role of similarity on the retention of perceived but unrehearsed verbal items over brief intervals (0-4 sec.) has both empirical and theoretical significance. It is important to know whether similarity has any effect on very-short-term memory and, if so, whether the empirical nature of these effects is the same as the empirical nature of those found in long-term memory. Also, whether or not similarity effects very-short-term memory is relevant to such theoretical issues as how many types of memory stores must be inferred and, if the data demand more than one, the characteristics of each.

The particular behavioral situation studied employs the shadowing technique of stimulus presentation combined with the probe technique of recall. Single alphanumeric items were presented on a Bina-Vue screen at a rate of 3/sec. and the subject read aloud each item as he perceived it. In the first of two experiments, 20 female subjects received 60 12-item sequences in each of two experimental sessions. The presentation of each sequence was followed by a recall test which presented one item from the sequence as a "probe" stimulus and required recall of the two items which had immediately succeeded it. Each sequence was divided into four successive blocks, and each block contained either three digits or three consonants. The probe stimulus was always the first item of one of the four blocks comprising a sequence.

In the second experiment, ten female subjects received 120 12-item sequences in each of four experimental sessions. Sequences were presented in the same manner as in the first experiment but differed in that (a) they were divided into six successive blocks and each block contained either two digits or two consonants, (b) in each sequence exactly one-half of the blocks contained consonants and the other half contained digits, and (c) only the one item immediately following the probe was to be recalled. The probe stimulus was always the first item of one of the six blocks comprising a sequence.

In both experiments, performance was found to be very sensitive to sequence structure. In the first experiment the number of similar-item blocks, whether they preceded or followed the items to be recalled, had a large and deleterious

effect on the subject's ability to recall. It also appeared that the proximity of the similar items to the item tested for recall decreased performance. The second experiment provided a more complete description of the effects on performance of the proximity of the similar-item blocks to the item tested for recall. Performance was worse when the similar items were adjacent to the tested items and appeared to vary little as the separation between the similar-item blocks and the items tested for recall increased beyond one interpolated block. A trade-off between proactive and retroactive similarity was implied by the fact that the average recall from a given serial position was essentially the same whether the two similar-item blocks (a) both preceded, (b) both followed, or (c) one preceded and one followed the to-be-recalled item.

The clear effects of similarity on very-short-term memory obtained in these two experiments are, in general, evidence aganist models which assume the retention from short-term memory, primary memory, or a buffer-like store is invariant with respect to the similarity between the surrounding items and the items to be retrieved.

236. Lindley, R.H. Words and pronunciation as coding aids. *Psychonomic Science*, 1966, 6(8), 395-396.

In Experiment I after an initial presentation of 1 or 2 to-be-recalled trigrams, E either spelled the items, pronounced them, or said related words. Pronounciation did not facilitate recall, whereas the related words did. Experiment II showed that the failure to find facilitatory effects of pronounciation in Experiment I was due to whether E or S did the spelling and pronouncing.

237. Lock, J.L. Short-term memory encoding strategies of the deaf. *Psychonomic Science*, 1970, 18(4), 233-234.

Deaf Ss, using an ABX procedure, evaluated nine consonant letters in terms of the subjective kinesthetic similarity of their dactylic representations. Ranked data were compared to short-term memory recall errors for the same stimuli in a similar group of deaf Ss (Conrad & Rush, 1965). Findings suggest that deaf Ss do not encode orthographic stimuli with a dactylo-kinesthetic system exclusively, if at all.

238. Loess, H. Short-term memory and item similarity. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 87-92.

Retention of word triads homogeneous with respect to taxonomic category (e.g., ROBIN-WREN-THRUSH) was measured individually by the Peterson method for four groups of 30 Ss. Triads were presented successively from each category or alternated among two or four categories. The results showed that (a) retention was maximal for the first item of each category; (b) retention significantly decreased for the second item of each category; (c) the majority of overt intrusions were attributable to prior items of the same category; and (d) transposition errors were more frequent than in studies using nonhomogeneous items. Results are interpreted as indicating that proactive inhibition is a function or recency and similarity in short-term memory.

239. Mackworth, Jane, F. Auditory short-term memory. *Canadian Journal of Psychology*, 1964, 18(4), 292-303.

Immediate recall of sets of digits, letters, and colour or shape names presented aurally resembled recall of visual material in the effects of material and message length, but more items were recalled when the messages were presented faster, in contrast to visual presentation. Vocal rehearsal during presentation reduced recall. Ten Ss were tested for each comparison.

240. Macnamara, J. The linguistic independence of bilinguals. *Journal of Verbal Learning and Verbal Behavior*, 1967, 6, 729-736.

Four tests were administered to bilingual student teachers (Irish-English) and to bilingual clerical students (Latin-English). The tests, which were all variants of the word-naming item in the Stanford-Binet, were : (1) word-naming in Irish (Latin for clerical students). (2) word-naming in English, (3) switching (without translation) from one language to the other, and (4) translation.

The results on Tests 1 and 2 showed substantial differences among student teachers in degree of bilingualism, and also that clerical students' fluency in Latin was inferior to the student teachers' fluency in Irish. As predicted, student teachers obtained lower mean scores in Tests 3 and 4 than in Test 1 and 2. Clerical students also obtained lower mean scores in Test 3 and 4 than in Test 2, but not lower than in Test 1. These findings are taken as confirmation for a theory of linguistic independence (the ability to keep languages functionally distinct)

based on limited associational networks among lexical items. No relationship was discovered between linguistic independence (test 3 and 4) and degree of bilingualism. A theory is proposed to explain these findings which may, it is felt, have general relevance to theories of how information is stored and retrieved as well as to theories of bilingualism.

241. Maltzman, I., & Belloni, Marigold. Three studies of semantic generalization. *Journal of Verbal Learning and Verbal Behavior*, 1964, 3, 231-235.

Three group paper-and-pencil studies of semantic generalization were conducted. The first experiment was an analogue of the Mink situation with the addition of a control group. A second experiment provided training in the absence of an overt response which was first evoked in the test situation. Reliable evidence of semantic generalization was obtained in Experiment II which did not differ reliably in degree from the results of Experiment I. Directionality of the words was reversed in Experiment III. No evidence of semantic generalization was obtained when the stimulus words were presented in the test situation, in accord with results from earlier experiments. The results support the interpretation that semantic generalization occurs in the training session in this kind of operant-conitioning situation.

242. Maltzman, I., & Langdon, B. Semantic generalization of the GSR as a function of semantic distance or the orienting reflex. *Journal of Experimental Psychology*, 1969, 80, 289-294.

The experiment was designed to investigate semantic generalization of the GSR as a function of connotative similarity as determined from semantic differential ratings and as a function of the order of presentation of the generalization test words. Half of the Ss were conditioned with a positively evaluated CS word and half with a negatively evaluated word. The CS conditions were subdivided into three groups for generalization: Group DS received the generalization test words in a decreasing order of connotative similarity from the CS word; Group IS received the test words in the order of increasing similarity; and Group R received their test words in different random orders. It was found that positive and negative CS words conditioned equally well. No reliable evidence was obtained of semantic generalization as a function of connotative similarity. Reliable gradients were obtained as a function of the order of presentation of the test words, indicating the influence of the orienting reflex evoked by the change from conditioning to

generalization test words. These results contradict Osgood's (1961) theory of reciprocally antagonistic representational mediation processes and his theory that semantic generalization may occur as a function of similarity in connotative meaning.

243. Maltzman, I., Langdon, B., & Feeney, D. Semantic generalization without prior conditioning. *Journal of Experimental Psychology*, 1970, 83(1), 73-75.

The Ss were instructed to perform a motor response when they heard a particular word. Control Ss received repeated presentations of that word interspersed among neutral words. Experimental Ss never received the training word to which they could respond. A generalization test followed, consisting of an associate of the training word interspersed among neutral words. Both groups showed reliable semantic generalization of the GSR. The results suggest that semantic generalization is more likely the consequence of complex processes of attention and thinking than vice versa.

244. Mandler, G. Organized recall: Individual functions. *Psychonomic Science*, 1968, 13(4), 235-236.

Individual Ss' recall of categorized lists is shown to vary systematically with number of categories used, adding about four words per category. The recall performance of an individual S can be manipulated and reliable individual Category-Recall functions were obtained. The study supports previous theoretical work on long-term memory and suggests further approaches to the study of individual differences in recall.

245. Mandler, G. Input variables and output strategies in free recall of categorized lists. *American Journal of Psychology*, 1969, 82, 531-540.

The Ss were required to learn categorized lists under three conditions: (1) under incrementing conditions, when only one new word was presented on each trial, (2) with constant serial order of the input list, and (3) with input order randomized from trial to trial. The first condition, which minimizes memory and processing overload, produced seriation or categorization as output strategies. Organization and clustering were superior for the constant-serial-input list over the random-input lists, even though all Ss in these conditions adopted a categorization strategy. The suggestion was made that random-input lists interfere with optimal organization of categorized lists in free recall.

246. Mandler, G., Pearlstone, Z., & Koopmans, H.S. Effects of organization and semantic similarity on recall and recognition. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 410-423.

Three experiments were performed to extend the previous finding that number of categories (NC) in organized, categorized lists determines the number of words recalled. The NC also influences recognition both in immediate tests and in a delay of two weeks. False alarm rates in recognition are generally unaffected by the use of synonyms as fillers, suggesting that perceptual features of words are used at least in addition to semantic features. To accommodate the novel finding that organization affects recognition, a model for the case of subject-organized lists was presented which introduces the notion of a postrecognition retrieval check. Previous findings on the relation between NC and recall were replicated.

247. Margrain, Susan, A. Short-term memory as a function of input modality. *Quarterly Journal of Experimental Psychology*, 1967, 12, 109-114.

The two experiments reported are concerned with short-term memory for digit lists simultaneously presented both auditorily and visually. Results showed (1) that interpolated written and verbal recall differentially affect retention depending on whether the to-be-recalled list was presented auditorily or visually. (2) That imput modality appears to be far more important for recall than was directing subjects' attention to a list during input, when that list might or might not have been subsequently required for recall. The results suggest that short-term storage is modality specific. In this case, Broadbent's P and S mechanisms do not adequately describe what happens during simultaneous visual and auditory presentation. Nor would Sperling's suggestion of a final auditory store appear to be supported.

248. Marks. L.E., & Miller, G.A. The role of semantic and syntactic constraints in the memorization of English sentences. *Journal of Verbal Learning and Verbal Behavior*, 1964, 3, 1-5.

Ninety-six Ss learned normal sentences, anomalous sentences, anagram strings, and word-lists for five trials by the method of free recall. The results demonstrate a differentiation between semantic and syntactic factors and a facilitory effect of both on learning.

249. Marshall, G.R. Effect of total association and conceptual cohesiveness among words on recall, clustering, and recognition association. *Psychological Reports*, 1967, 20, 39-44. (a)

Two indices of verbal relatedness, the Index of Total Association (ITA) and the Index of Concept Cohesiveness (ICC) computed from single-response free word-associations were used to design lists of words presented to Ss for free recall for three successive trials. Amount of free recall and clustering in recall were significantly related to ITA, ICC, and trials. Amount recall was more sensitive to total association (ITA) than to recoding processes (ICC); clustering was sensitive to both. The recognition of word sets subsequent to list presentation was systematically related to the ITA and ICC of the word sets.

250. Marshall, G.R. Stimulus characteristics contributing to organization in free recall. *Journal of Verbal Learning and Verbal Behavior*, 1967, 6, 364-374. (b)

Three experiments are reported on the extent to which measured association and other stimulus characteristics contribute to organization in free recall. The Ss were presented with lists of word pairs in different mixed orders for 3 or 4 trials, and free-recall clustering scores were obtained. Subsequent recognition scores of word-pair relatedness were also obtained in Exps. 2 and 3. The results show that measured association (MR), categorization, set, trials, and pattern of association were significantly related to clustering. As MR increased, clustering increased. Categorization increased the clustering of weak and moderately associated pairs. Set increased the clustering of highly associated pairs. As trials increased, clustering increased and an increase in MR between word pairs gave rise to a larger effect of trials on clustering. Direct association increased the clustering of both categorized and non-categorized pairs. Idiosynacratic association, analyzed from recognition-association scores obtained after free recall of the word lists, appeared to be lawfully related to clustering: as strength of association decreased, idiosyncratic clustering increased.

251. Marshall, G.R. The organization of verbal material in free recall: The effects of patterns of associative overlap clustering. *Dissertation Abstracts*, 1966, 26, 6171.

The phenomenon of central interest in the present thesis has been clustering in free recall as a measure of some "coding" or "organizing" process. Clustering is the contiguous free recall of related words. The experiments have demonstrated that this "coding" or "organization" in free recall is a function of different variables, at different times under varying conditions.

One independent variable that has been strongly emphasized in the literature is strength of measured association. Although it is important, it is not the only variable of significance. The first experiment demonstrated that at high levels of association, "coding" or "organization" in free recall is a simple function of strength of association. However, in a narrow but important mid-range of association, category or concept relationships significantly increased clustering in free recall above and beyond the affects of association. "Coding" processes in this mid-range of association are, therefore, a function of strength of association and conceptual relationships.

The first experiment also revealed that the organization process in free recall, at low levels of measured association is just as much a function of idosyncratic association as any other identifiable variable.

Another factor which influences free recall organization is pattern of association. When categorized and non-categorized word pairs are directly associated they cluster more than when they are non-directly associated, although they have been equated for mean strength of association.

An increase in trials practice also increases clustering in free recall.

One can, therefore, identify five variables here which significantly influence the "coding" or "organization" process in free recall in the word pair situation, namely, strength of association, pattern of association, category or concept membership, trials and "idiosyncratic" association.

In experiment I trials is the only variable which has a marked and consistent affect on recall. Even though level of association is a statistically significant variable, an increase in association did not consistently led to an increase in recall. Categorized words were recalled significantly more

than non-categorized but the absolute mean difference consists of about one-third of a word. These findings lead to the conclusion that, although strength of association and category membership increase recall, their absolute affects are quite small.

Experiment 2 demonstrated that pattern of association had very little affect on amount of recall.

The prediction of certain phenomena in verbal behavior task, such as clustering in free recall and amount of free recall, has often been attempted through the use of associative indices. By and large, these indices are designed to reflect strength or level of association. However, indices can be designed to reflect pattern of association and comceptual relationships using the same basic "measuring device," the single response, free, word association cultural norms.

In the third experiment, two indices were designed to measure total association and concept cohesiveness. It was found that these two indices could be manipulated to operate independently. A parametric study using three different levels of total association, three different levels of concept cohesiveness and three stages of practic (trials) demonstrated that all three variables, total association, concept cohesiveness and trials significantly affected organization in free recall.

In experiment three, trials and strength of association also influence amount of recall, but the affect of association on recall was only apparent at the highest level of association. Concept cohesiveness has very little affect on recall.

In each of the three experiments of this thesis an associative index was used to measure strength or level of word relatedness and the last experiment varied the index of concept cohesiveness which is essentially a pattern of association measure. Associative indices, which reflect different forms of verbal relatedness, may assist investigators in describing the complexity but inherent lawfulness of verbal behavior.

252. Marshall, J.C., & Newcombe, Freda. Syntactic and semantic errors in paralexia. *Neuropsychologia*, 1966, 4, 169-176.

A case of selective dysphasic impairment resulting from gunshot injury is reported. The numerous paralexia errors made to different parts of speech are analysed. The preponderance of semantic errors and specific facilitation of noun responses are discussed.

253. Marshall, J.F., Rouse, R.O., & Tarpy, R.M. Acoustic versus associative models of short-term memory coding. *Psychonomic Science*, 1969, 14(2), 54-55.

A 230-item word list was used to study methods of coding. The list consisted of 35 pivot words, one each of their high associates (HA), medium associates (MA), synonyms (S), rhymes (R), plus 20 buffer words. The data indicated that short-term memory complied to an associative rather than an acoustical model. The study offers a possible explanation of why different experiments have found acoustical coding predominant in short-term memory.

254. Masters, Laraine. Knowledge of results and item associability in paired-associates learning. *American Journal of Psychology*, 1970, 83(1), 76-85.

The effects of percentage of knowledge of results (KR) and associability of items were investigated in the acquisition and extinction of paired associates. Two levels of each of these variables were factorially combined to produce four treatment groups of 24 undergraduates each. Both factors affected acquisition: 50% KR groups took longer to reach criterion than did 100% KR groups; low-associability groups took longer to reach criterion than did high-associability groups. Withdrawal of knowledge of results produced an increase in correct responses over trials for all groups. Natural language mediators were recorded and shown to faciliate accuracy during acquisition. Both acquisition and extinction were characterized by a dropping out of these mediators.

255. Mathews, Ravenna. Recall as a function of number of classificatory categories. *Journal of Experimental Psychology*, 1954, 47(4), 241-247.

The problem investigated was how the number of categories into which a body of items is classified affects the recall of the items.

The Ss classified names of famous people into 2, 3, or 6 categories. The different lists of names used were equated on the basis of controlled association data. On recall tests 10 min. after the classification of the names, Ss who had been given 6 categories recalled significantly more names on the average than those who had been given 3 categories, who in turn recalled significantly more names on the average than those who had used 2 categories. Intrusions vaired inversely with number of categories.

The results are interpreted in terms of interference among the items of the experimental list and between those on the list and other familiar items in the S's "parent-categories."

256. Matthews, W.A. Continued word associations and free recall. *Quarterly Journal of Experimental Psychology*, 1966, 18, 31-38.

Two experiments on the short-term free recall of 12-word associated and non-associated lists are reported. Degree of association (derived from norms obtained by continuous controlled association) and word frequency were varied. Significant facilitation as a result of the associative manipulations was obtained and clustering of the responses was positively related to this. Clustering was also affected by the method of presentation of the associated words; this occurred more often when they were grouped in presentation than when they were presented randomly arranged among other words in the list. Low frequency associated word lists were generally found to be more efficiently recalled than those of comparable association values but consisting of high frequency words.

257. Matthews, W.A., Marcer, D., & Morgan, E. Word association hierarchies and free recall. *Journal of Verbal Learning and Verbal Behavior*, 1964, 3, 371-375.

Two experiments are reported in which the relationship of association norms derived from continuous association to free recall is investigated. Twelve-item lists, varying in associative frequency, were presented auditorily. There were four groups of three associated words each which were presented either in three or distributed randomly. A positive relationship was found between the association frequency and the number of items recalled. This relationship was more consistent for the presentation in threes than for the randomized presentation. Organization of the recalled material into three-word groups was a perdominant strategy.

258. Mayzner, M.S., & Tresselt, M.E. Incidental learning: A function of associative strength and distance between S-R pairs. *Journal of Psychology*, 1961, 53, 155-160.

The present study examined the effects of two variables, associative strength and distance between S-R pairs, in an incidental learning task. The results showed that word lists comprised of S-R pairs with high associative strength yield greater recall scores and more associative clustering than word lists comprised of S-R pairs with low associative strength. However, associative strength and S-R distance were found to significantly interact, producing greater recall scores and more associative clustering when S-R distance is small rather than large, for high associative strength lists, but producing no difference in low associative strength lists.

259. McCullers, J.C. An analysis of some factors underlying intralist associative transfer in paired-associate learning. *Dissertation Abstracts*, 1962, 22, 3747.

A within-list method proposed by Spence for assessing associative strength and degree of competition in paired-associate learning served as the basis of a logical analysis. With Spence's method as the basic model (I), the analysis resulted in the formulation of two new models (II and III). In each condition the solid-shaft arrows indicate initially strong associative connections; broken-shaft arrows depict initially weak connections. As may be seen, Models II and III differed from I in the number of competitive connections and from one another in the type of competitive connections initially present in the task. The three basic models were studied at two levels of associative strength of competitive connection among 96 sixth grade boys and girls in a verbal paired-associate learning situation. In each of the six conditions, subjects learned both strongly associated and weakly associated word pairs. In Condition I, parallelling Model I, two types of competitive connections were present in the list. These were (a) an interstimulus item connection in which the stimulus items of a strong and weak pair were associatively related, and (b) an inter-word pair S-R connection in which the stimulus item of a weak pair and the response item of a strong pair were associatively related. For Condition II, type "a" interference was present but type "b" was minimized; for III, on the other hand, type "b" was present while "a" was minimized.

The results supported the hypothesis that number, type and strength of competitive connections are important factors in determining the degree of intralist associative transfer in a paired-associate task. The implication arising from these findings was that the new models, (II and III), might prove less complicated psychologically than the original method for the purpose of assessing the habit-drive interaction.

260. Melton, A.W. Implications of short-term memory for a general theory of memory. *Journal of Verbal Learning and Verbal Behavior*, 1963, 2, 1-21.

The revival of interest in short-term memory and the new techniques that have been devised for the analysis of short-term memory will enrich and extend our understanding of human memory far beyond what could have been accomplished by the most assiduous exploitation of the techniques of rote memorization of lists of verbal units. In fact, our evidence on STM for near-span and supra-span verbal units suggest that the systematic exploration of the retention of varying sizes of units over short and long time intervals will give new meaning to research employing lists.

261. Miller, G.A. The magical number seven, plus or minus two: Some limits on our capacity for processing information. *Psychological Review*, 1956, 63(2), 81-96.

I have come to the end of the data that I wanted to present, so I would like now to make some summarizing remarks.

First, the span of absolute judgment and the span of immediate memory impose severe limitations on the amount of information that we are able to receive, process, and remember. By organizing the stimulus input simultaneously into several dimensions and successively into a sequence of chunks, we manage to break (or at least stretch) this informational bottleneck.

Second, the process of recoding is a very important one in human psychology and deserves much more explicit attention than it has received. In particular, the kind of linguistic recoding that people do seems to me to be the very lifeblood of the thought processes. Recoding procedures are a constant concern to clinicians, social psychologists, linguists, and anthropologists and yet, probably because recoding is less accessible to experimental manipulation than nonsense syllables or T mazes, the traditional experimental psychologist has contributed little or nothing to their analysis. Nevertheless,

experimental techniques can be used, methods of recoding can be specified, behavioral indicants can be found. And I anticipate that we will find a very orderly set of relations describing what now seems an uncharted wilderness of individual differences.

Third, the concepts and measures provided by the theory of information provide a quantitative way of getting at some of these questions. The theory provides us with a yardstick for calibrating our stimulus materials and for measuring the performance of our subjects. In the interest of communication I have suppressed the technical details of information measurement and have tried to express the ideas in more familiar terms; I hope this paraphrase will not lead you to think they are not useful in research. Informational concepts have already proved valuable in the study of discrimination and of language; they promise a great deal in the study of learning and memory; and it has even been proposed that they can be useful in the study of concept formation. A lot of questions that seemed fruitless twenty or thirty years ago may now be worth another look. In fact, I feel that my story here must stop just as it begins to get really interesting.

And finally, what about the magical number seven? What about the seven wonders of the world, the sever seas, the seven deadly sins, the seven daughters of Altas in the Pleiades, the seven ages of man, the seven levels of hell, the seven primary colors, the seven notes of the musical scale, and the seven days of the week? What about the seven-point rating scale, the seven categories for absolute judgment, the seven objects in the span of attention, and the seven digits in the span of immediate memory? For the present I propose to withhold judgment. Perhaps there is something deep and profound behind all these sevens, something just calling out for us to us to discover it. But I suspect that it is only a pernicious, Pythagorean coincidence.

262. Miller, G.A., & Nicely, Patricia, E. An analysis of perceptual confusions among some English consonants. *Journal of the Acoustical Society of America*, 1955, 27(2), 338-352.

Sixteen English consonants were spoken over voice communication systems with frequency distortion and with random masking noise. The listeners were forced to guess at every sound and a count was made of all the different errors that resulted when one sound was confused with another. With noise or low-pass filtering the confusions fall into consistent patterns, but with high-pass filtering the errors are scattered quite randomly. An articulatory analysis of these 16 consonants provides a system of five articulatory features or "dimensions"

that serve to characterize and distinguish the different phonemes: voicing, nasality, affrication, duration, and place of articulation. The data indicate that voicing and nasality are little affected and that place is severely affected by low-pass and noisy systems. The indications are that the perception of any one of these five features is relatively independent of the perception of the others, so that it is as if five separate, simple channels were involved rather than a single complex channel.

263. Mink, W.D. Semantic generalization as related to word association. *Psychological Reports*, 1963, 12, 59-67.

Ss were taught to press a lever to each word of a list of words presented on a memory drum. Then a second list was presented which contained the original words, associated words occurring with known frequency as word association test responses to some of the original words, and unassociated control words. Ss were instructed to press the lever when words were recognized from the original list. Generalization was considered to have occurred if the number of responses to associated words was significantly greater than to control words. A series of four experiments was performed to test certain functional relationships between characteristics of the word lists and the amount of generalization. No generalization occurred in two experiments which were designed to permit mediation effects during the test stage of the experiments. Significant and near significant generalization was found in the two experiments where the design permitted implicit associations to be formed during the learning stage of the experiment. The direction of association seemed to be an important factor in the results since bidirectional effects were not obtained. A rough relationship between amount of generalization and strength of word association was suggessted by the results.

264. Morgan, R.L., & Underwood, B.J. Proactive inhibition as a function of response similarity. *Journal of Experimental Psychology*, 1950, 40. 592-603.

The experiment was designed to determine the influence of response similarity on proactive inhibition and associative facilitation. Twenty-four Ss learned lists of 12 paired two-syllable adjectives by the anticipation method. The degree of synonymity between response items in the two lists for each of five experimental conditions was varied systematically. On all conditions the two lists used had identical stimuli. The two lists were learned successively to a criterion of seven correct anticipations on a single trial, and the second list

was recalled and relearned to a criterion of one perfect trial after 20-min. rest interval. A sixth condition, on which a single list was learned and relearned after 20 min., served as the control condition. The results showed:

1. Associative facilitation in learning the second list increased as response synonymity increased. Increase in response similarity was also accompained by an increase in number of intrusions from the first list during the learning of the second.

2. Proactive inhibition of recall tended to decrease as response similarity increased, although singificant proactive inhibition resulted only when responses were dissimilar. Inter-list intrusions during recall and relearning showed no systematic relationship with response similarity.

A fairly complete interpretation of the results on associative facilitation has been given by using the concept of parasitic reinforcement brought about by response generalization. The interpretation has been less complete for the recall results.

265. Morris, E., & Ortof, Edna. The effect of level of attention upon "phonetic" recognition errors. *Journal of Verbal Learning and Verbal Behavior*, 1967, 6, 226-231.

Subjects were given a single presentation of 26 words, with instructions to try to memorize them under two different conditions: (a) focal attention, and (b) while simultaneously performing another task (distraction). The distraction group showed more recognition errors based on acoustic similarity (clang errors) than did the focal attention group. It was shown that these errors could not be attributed to failure of discrimination during stimulus presentation. Rather, the results can be explained by the hypothesis that reduced attention tends to block analysis of incoming stimuli. Hence, some stimuli in the distraction condition were stored in memory primarily on the basis of assonance.

266. Morton, J. Interaction of information in word recognition. *Psychological Review*, 1969, 76(2), 165-178.

Quantitative predications are made from a model for word recognition. The model has as its central feature a set of "logogens": devices which accept information relevant to a particular word response irrespective of the source of this information. When more than a threshold amount of information has accumulated in any logogen, that particular response becomes available for responding. The model is tested against data available on the effect of word frequency on recognition, the effect of limiting the number of response alternatives, the interaction of stimulus and context, and the interaction of successive presentations of stimuli. The implications of the underlying model are largely upheld. Other possible models for word recognition are discussed as are the implications of the Logogen Model for theories of memory.

267. Murdock, B.B., Jr. Modality effects in short-term memory: Storage or retrieval? *Journal of Experimental Psychology*, 1968, 77(1), 79-86.

2 experiments were conducted to determine whether the superiority of auditory to visual presentation was due to differences in storage or in retrieval from short-term memory (STM). The 1st experiment compared recognition and recall with serial lists, under the presumption that retrieval difficulties would be minimized or eliminated with a recognition procedure. The 2nd experiment utilized a confidence-rating procedure (test for knowledge of list membership) which eliminated the need for sequential dependencies. The superiority of auditory presentation was manifest in both experiments, and the conclusion was suggested that modality effects represent differences in storage.

268. Murdock, B.B., Jr. Recent developments in short-term memory. *British Journal of Psychology*, 1967, 58, 421-434.

This paper reviews some recent developments in the area of short-term memory. The methodological innovations include the distractor technique and the probe technique. The main empirical phenomena discussed are recency effects, input and output interference, the length-difficulty relationship, inter-item interference, proactive interference effects, the distribution of practice interaction, associative symmetry, modality effect, acoustic confusions, and transpositions. A 'modal model' is presented which attempts to synthesize some recent theoretical conceptions; the components include sensory, short-term and long-term stores with three different forgetting mechanisms (decay, displacement and interference, respectively).

269. Murdock, B.B., Jr. Visual and auditory stores in short-term memory. *Quarterly Journal of Experimental Psychology*, 1966, 18, 206-211.

If retrieval in short-term memory can be either from a pre-perceptual sensory store or from a post-perceptual memory then recall should vary as a function of input into sensory store. To test this possibility two experiments with paired associates compared visual and auditory presentation under conditions as comparable as possible. In both experiments modality interacted with retention interval: more recency with auditory but, in Experiment I, more primacy with visual. The interaction was taken as support for the hypothesis. An alternative hypothesis (that storage is post-perceptual but not a historical) was discussed and weak negative evidence presented.

270. Murdock, B.B., Jr., & vom Saal, W. Transpositions in short-term memory. *Journal of Experimental Psychology*, 1967, 74(1), 137-143.

This study attempted to determine whether transpositions occur during storage or during retrieval. A distractor task (Peterson & Peterson technique) was used in which word trigrams were followed by a variable-length retention interval. Words were used to minimize acoustic confusions, and the trigrams were composed of same-category or different-category items (e.g., GRAY BROWN RED vs. EEL SCREW LOUNGE). The same-category trigrams were better retained than the different-category trigrams but also transposed more. In addition, transpositions increased in frequency over the retention intervals used. Conrad has suggested that transpositions do not occur during storage; the results obtained here suggest the opposite conclusion.

271. Murdock, B.B., Jr., & Walker, K.D. Modality effects in free recall. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 665-676.

Three experiments compared auditory and visual presentation in single-trial free recall. Experiment I used 20-word auditory or visual lists; Experiment II used mixed lists either 10-10, 2-10-8, 5-5-5-5, or random; Experiment III used 10-word lists either auditory, visual, or random. Modality affected the recency part of the serial position curve but not the asymptote, mixed-list presentation greatly magnified the auditory superiority, and the order of recall was organized by mode of presentation. The results seemed clearly inconsistent with a Sperling-type one-store model and somewhat at variance with the Morton logogen model. Instead it was reaffirmed that there are separate prelinguistic auditory and visual short-term stores which may have persistence at least as long as 5-10 sec.

272. Murray, D.J. Intralist interference and rehearsal time in short-term memory. *Canadian Journal of Psychology*, 1966, 20(4), 413-426.

Three experiments are reported in which items required for immediate recall were alternated with "interfering" items not required for recall, but demanding overt responses. Presentation rate was also varied. In Experiment I letters were alternated with "interfering" digits: having to calculate the digits mentally led to reduced recall of the letters. In Experiment II "required" letters were repeated, three presentation rates also being used: lists with repetitions were more poorly recalled than lists without repetitions, but in the former condition, the slower the rate, the better was recall. In Experiment III "required" letters were alternated with digits or rhyming letters: letter interference produced poorer recall, but there was also an interaction with presentation rate. An "interfering" letter closely preceding a "required" letter was more likely to replace the latter in recall than was one preceding it at a longer interval. It is argued that both rehearsal opportunity and response competition determined recall, and that simple versions of decay theory or interference theory are inadequate to cover all these results.

273. Murray, D.J. The role of speech responses in short-term memory. *Canadian Journal of Psychology*, 1967, 21(3), 263-276.

Three experiments are reported in which Ss saw lists of letters for immediate recall, but had to say a neutral sound as they perceived each letter. In Experiment I this technique substantially reduced recall of letters, spoken as capitals, as compared with that for normally voiced lists, but no difference between "suppression" and voicing emerged if the letters were pronounced in altered fashion (e.g., BDF pronounced as "buh duh fuh..."). In Experiment II, having to say a sound which coincided with the dominant sound of the presented list led to slightly poorer recall than did the saying of non-coincident sounds at presentation. Experiment III showed that the main advantages for recall of articulation consisted in raising the recall particularly of lists of low acoustic similarity, reducing order errors, and raising the recall particularly of the early and middle items of lists (the latter only if articulation was normally intoned as opposed to monotonous). It is concluded that the advantage of articulation at presentation increases as the acoustic similarity of the items decreases. Some general implications concerning STM are drawn from this conclusion.

274. Murry, D.J. Articulation and acoustic confusability in short-term memory. *Journal of Experimental Psychology*, 1968, 78(4), 679-684.

Lists of letters varying in length and in acoustic confusability were presented for immediate probed recall. Presentation was either visual (with nonarticulation, silent articulation, or articulation aloud) or auditory (with nonarticulation or silent articulation). It was found that recent visual items which were articulated gave acoustic confusability effects intermediate between the heavy effects obtained when retrieval was ostensibly from an auditory afterecho and the negligible effects obtained when retrieval was ostensibly based on visual memory. These results suggest that articulation enhances the discriminability particularly of recent items in STM, and also that visual or auditory STM can be investigated independently of STM for speech-coded information.

275. Musgrave, Barbara, S., & Allen, Susan. Clustering with two-word stimuli each composed of a categorized and a noncategorized word. *Psychonomic Science*, 1968, 11(8), 289-290.

For a free-recall task, words of high conceptual similarity (H) were each paired with a word of low conceptual similarity (L). These word pairs were written either side by side as two-word stimuli, or consecutively one below the other as one-word stimuli. All responses were written as a list of single words, recalled in any order. More H words were recalled than L words. H words clustered by category. Also, LH pairs of words presented side by side clustered increasingly over three trials: whereas, the same words presented consecutively did not.

276. Myers, T.F. Asymmetry and attention in phonic decoding. *Acta Psychologia*, 1970, 33, 158-177.

Dichotic digits experiments which have shown a laterality effect favouring the right ear do not provide clear evidence for a perceptual asymmetry (cf. KIMURA, 1961). Control for order of report bias reveals that the major component of laterality is attributable to short-term storage. But perceptual asymmetry (PA) at the phonic level has been demonstrated at Haskins.

A Kimura-Fant account (auditory) of PA which emphasis acoustic cues e.g., the formant transition pattern, may be more appropriate than a Kimura-Liberman account (motor). An attention-based explanation should also be considered.

Experiments are reported which (1) differentiate between two components of laterality: voluntary attentional bias and PA; (2) suggest the primary role of formant transitions in PA, and (3) attempt to relate PA to temporal normalization.

277. Nelson, D.L. Information theory and stimulus encoding in free and serial recall: Ordinal position of formal similarity. *Journal of Experimental Psychology*, 1969, 80(3), 537-541.

Information theory analyses of three-letter English words show that beginning and end letters carry more information than middle letters and that beginning letters carry more than end letters. Each S acquired a single list of three-letter words in which there were zero identical letters within a given ordinal position or identical letters in only the first, middle, or last or first-and-middle, first-and-last, or middle-and-last letter positions. Half of the Ss in each of these conditions practiced the list by the method of free recall and half by the method of serial recall. Ease of free recall increased in the order middle, last, and first for single-locus conditions and in the order middle-and-last, first-and-middle, and first-and-last for dual-locus conditions. This ordering of identity conditions was reversed for serial recall. The direction of this significant Method of Recall X Identity Conditions interaction was interpreted as being consistent with the hypothesis that words are processed on the basis of informational structure.

278. Nelson, D.L. Paired-associate acquisition as a function of association value, degree, and location of similarity. *Journal of Experimental Psychology*, 1968, 77(3), 364-369.

In Experiment I S acquired a list of 12 pairs by the anticipation method. Variations of trigram stimulus characteristics included 3 levels of association value, 3 levels of interstimulus similarity, and 2 conditions of locus of identity. Control lists having zero-identity letters were constructed at each level of association value. When similarity was located in the initial letter position and stimuli were medium or high in association value, difficulty increased from zero to complete identity. Location of similarity in the last letter position did not impair acquisition rate as severely. Under conditions of low association value difficulty was independent of similarity regardless of locus. In Experiment II S acquired a paired-associate list representing either low or high association value in which there was high similarity in both 1st and last letter locations. For conditions of low and high association value, identity in both 1st and last letter positions increased difficulty significantly beyond that obtained when identity was only in the 1st position and only in the last position.

279. Nelson, D.L., & Garland, R.M. Amount and locus of stimulus-response overlap in paired-associate acquisition. *Journal of Experimental Psychology*, 1969, 82, 297-300.

Each S acquired a single list of three-letter-word paired associates. Stimuli shared zero, first, middle, last, first-and-middle, first-and-last, or middle-and-last letters with their responses. On the basis of data suggesting that some ordinal positions within the word sequence are more critical determinants of word processing than others, differential acquisition rates for these conditions were predicted. Two alternative explanations of the findings were discussed, one assuming that the informational structure of the language has sensitized speakers of the language to attend to high-information parts of words, and one assuming that words are processed as serial sequences.

280. Nelson, D.L., & Nelson, Louise, D. Rated acoustic (articulartory) similarity for word pairs varying in number and ordinal position of common letters. *Psychonomic Science*, 1970, 19(2), 81-82.

Ratings of "similarity-in-sound" for pairs of words sharing letters in various ordinal positions were obtained using a 7-category graphic scale on which degrees of similarity were specified by verbal labels. Judged acoustic (articulartory) similarity increased as number of shared letters increased from zero to one, two, and three letters. Pairs overlapping in first letters were rated significantly more similar than pairs sharing middle or last letters. For pairs sharing letters within two ordinal positions, judged similarity increased in the order of first-and-middle, first-and-last, middle-and-last. Implications for the hypothesis that verbal stimuli are coded by pronounciation were discussed.

281. Nelson, D.L., & Rowe, F.A. Information theory and stimulus encoding in paired-associate acquisition: Ordinal position of formal similarity. *Journal of Experimental Psychology*, 1969, 79(2), 342-346.

Statistical analyses of English words show that beginning and end letters carry more information than middle letters and that beginning letters carry more than end letters. The experiments were performed in which the ordinal position of identical letters within the three-letter word stimuli of paired-associate lists was varied. Each S acquired a single list in which there were identical letters in only the first, middle, or last, or first-and-middle, first-and-last, and middle-and-last letter positions. A zero-identity condition and a condition with identity in first-middle-and-last letter positions were also

constructed. Consistent with predictions derived from the informational analyses, difficulty of acquisition varied with the location of information which could be used to discriminate between stimuli and the degree to which the location of this information was incompatible with encoding habits.

282. Nelson D.L., Rowe, F.A., Engel, Jane, E., Wheeler, J., & Garland, R.M. Backward relative to forward recall as a function of stimulus meaningfulness and formal interstimulus similarity. *Journal of Experimental Psychology*, 1970, 83(2), 323-328.

The present experiments were designed to test the hypothesis that as the nominal-functional stimulus discrepancy decreases with increasing meaningfulness and similarity, resultant differences between forward and backward recall should decrease. In Exp. I, different groups learned paired-associate (PA) lists in which high and low stimulus meaningfulness was factorially combined with variations of high and low stimulus similarity. Response terms were the digits 1-8. Following acquisition, half of the Ss were given stimuli, requiring response recall, and half were given responses, requiring stimulus recall. Experiment II was designed to control for the confounding of recall direction with type of material recalled inherent in Exp. I. In general, relative differences between forward and backward recall decreased with increasing meaningfulness and similarity, providing tentative support for the hypothesis. The findings of Exp. III, in which the trygrams were learned by the method of free recall, suggested that the similarity-recall relationships obtained following PA acquisition were not a result increased availability due to organizational factors.

283. Newman, S.E. Multitrial free recall: Effects of clustered presentation, element-sharing, and instructions. *Journal of Verbal Learning and Verbal Behavior*, 1967, 6, 844-850.

Two experiments are reported in which Ss were given 40 free-recall trials to learn a list of 9 CCC trigrams. In Exp. I, clustered (compared with separated) presentation of items from the same class was found to facilitate performance. Acquisition was not affected by element-sharing (i.e., formal similarity) between items of the same class. In Exp. II clustered presentation again facilitated performance. Though the effect did not occur when Ss were told about the structure of the list and were instructed to recall the items in clusters, it did occur when (as in Exp. I) Ss were not given such instructions.

284. Newman, S.E., & Buckhout, R. S-R and R-S learning as functions of intralist similarity. *American Journal of Psychology*, 1962, 75, 429-436.

Results of the present study suggest that as similarity is increased among S-terms and among R-terms, the number of correct responses during R-S recall decreases and (at least at low levels of R-term similarity) the rate of S-R learning tends to decrease. These findings tend to support predictions based on generalization-theory. Possible loci of interference due to increase in S-term and R-term similarity were identified.

285. Newman, S.E., & Taylor, L.R. Context effects in paired-associate learning as a function of element-sharing among stimulus terms. *Journal of Verbal Learning and Verbal Behavior*, 1963, 1, 243-249.

This experiment tested the hypothesis that the tendency for the dominant response in the final hierarchy for a stimulus term to be to its context element is a direct function of the number of primary elements shared by the term with other stimulus terms in the list. The data were interpreted as supporting the hypothesis. Additional effects of element-sharing and context elements are discussed.

286. Norman, D.A. Comments on the information structure of memory. *Acta Psychologica*, 1970, 33, 293-303.

Human memory is used in many different ways for many different tasks. By studying the various uses of memory we can learn about its properties. Pattern recognition requires efficient use of contextual information and previously learned information. The evidence from experiments on simultaneous attention leads us to a similar conclusion: we need a combination of active and passive analyzing systems and a memory system based on a sensory addressible stage. The search of long-term memory has many aspects of a problem-solving task. We find strategies and logic playing as important a role as the actual information that can be retrieved. The memory requirements seem to imply that the memory addressing scheme should be one that is content addressible.

287. Norman, D.A. Toward a theory of memory and attention. *Psychological Review*, 1968, 75(6), 522-536.

A theoretical structure is described to account for a variety of phenomena encountered in the study of perception, attention, and memory. A storage system is proposed which has 2 different modes of activation: a temporary excitation, called short-term or primary storage, and a permanent excitation, called long-term or secondary storage. The storage is assumed to be organized so that access to stored information can be made directly from a sensory code. Thus, the initial interpretation of sensory events can be performed automatically, allowing attention to be directed to events on the basis of their meaning and momentary psychological pertinence. A retrieval process is described to handle the problem of deciding when an item is recovered from storage is that which was sought. The output from storage is accepted as valid only if it can lead back naturally to the original query of memory. If it cannot, the retrieval process continues, using the initial query together with each intermediate output to guide the direction of search.

288. Nott, Ruth, C., & Lambert, W.E. Free recall of bilinguals. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 1065-1071.

Bilinguals were required to free-recall lists of words in each of their languages and also bilingual lists. It has been found that bilinguals recalled fewer words from lists in their weaker language and from bilingual lists only if list words could be grouped into semantic categories. These differences between language conditions failed to appear on "non-category" lists and the present results supported this finding. In an effort to discover why these differences appeared on category lists, the steps of detecting the nature of the categories and of reshuffling the words into categories were isolated. Aid in detecting the categories did not significantly improve performance but presenting the words grouped by categories did. However, blocking improved recall equally in all three language conditions. Therefore, it was argued that the inferior recall of category lists which were in a weaker language or bilingual was not due to greater difficulty in reorganizing the words during list presentation. Other possible explanations were suggested.

289. Osgood, C.E. Meaningful similarity and interference in learning. *Journal of Experimental Psychology*, 1946, 36(4), 277-300.

Comparison of studies supporting the Skaggs-Robinson hypothesis with those by McGeoch and others using meaningful materials presents a paradox: the former find retroaction to be a decreasing function of similarity (high degrees), while the latter find it to be an increasing function. The McGeoch studies all follow a learning paradigm in which both stimulus and response members are simultaneously varied. The present experiment follows the traditional retroactive inhibition paradigm--A-B; A-K; A-B--in which the stimulus members are constant. The experimental variable is the meaningful relationship between B and K adjectives.

The obtained results show that both proactive and retroactive interference are significantly less for similar adjectives than for either neutral adjectives or adjectives opposed in meaning. Opposed meanings produce more retroactive interference than neutral meanings, but the obtained differences are not significant.

The following conclusions are drawn: (1) the widely accepted statement--'the greater the meaningful similarity, the greater the interference'--does not have general validity. (2) Interference in learning may be either an increasing or a decreasing function of similarity, depending on the stimulus-response relationships in the materials successively practiced. (3) Intrusion results of this experiment are analyzed in relation to current theories as to the cause of retroactive inhibition, and neither McGeoch's 'competition-of-responses' factor nor Melton's 'Factor X' incorporates them.

290. Otto, W. Intralist similarity, order of presentation and color in children's paired-associate learning. *Psychonomic Science*, 1967, 9(10), 531-532.

Analyses of acquisition trials showed that second graders' learning was more rapid with low than with high intralist similarity and with serial than with scrambled presentation, but the provision of color cues had no significant effect. Removal of the color cues, however, had an adverse effect upon subsequent performance.

291. Paivio, A. Mental imagery in associative learning and memory. *Psychological Review*, 1969, 76(3), 241-263.

Nonverbal imagery and verbal symbolic processes are considered in relation to associative learning and memory. These two hypothesized processes are operationally distinguished in terms of stimulus attributes and experimental procedures designed to make them differentially available as associative mediators or memory codes. The availability of imagery is assumed to vary directly with item concreteness or image-evoking (I) value, whereas verbal processes are presumably independent of concreteness but functionally linked to meaningfulness (m) and codability. Stimulus characteristics are hypothesized to interact with mediation instructions, presentation rates, and type of memory task. Performance and subjective-report data resulting from experimental test of the model indicated that imagery-concreteness is the most potent stimulus attribute yet identified among meaningful items, while m and other relevant attributes are relatively ineffective; that both processes can be effectively manipulated by mediation instructions, but imagery is a "preferred" mediator when at least one member of the pair is relatively concrete; and that the two mechanisms are differentially effective in sequential and nonsequential memory tasks. The findings substantiate the explanatory and heuristic value of the imagery concept.

292. Paivio, A., & Csapo, K. Concrete image and verbal memory codes. *Journal of Experimental Psychology*, 1969, 80, 279-285.

It was hypothesized that concrete (visual) imagery functions primarily as a parallel processing system, whereas the verbal symbolic system is specialized for sequential processing; and that performance in nonsequential memory task would accordingly vary directly with the availability of both memory codes, but the verbal code alone would be crucial in sequential memory. The availability of imagery was manipulated by the use of abstract words, concrete words, and easily labeled pictures as stimuli. The availability of the verbal code, in the case of pictures, was varied by presenting the stimuli at rate presumably above and below implicit labeling threshold. Immediate memory span and serial learning constituted the sequential tasks; free recall and recognition memory, the nonsequential tasks. Consistent with predictions (a) memory for pictures was significantly inferior to words only in the sequential memory tasks, and then only at the fast rate; (b) both pictures and concrete words exceeded the abstract words in serial learning at the slow rate; and (c) pictures were significantly superior to abstract words at the slow rate in both nonsequential tasks, with concrete words intermediate in each case.

293. Paul, C., & Silverstein, A. Relation of experimentally produced interlist intrusions to unlearning and retroactive inhibition. *Journal of Experimental Psychology*, 1968, 76(3), 480-485.

3 groups of Ss learned an A-B paired-associate list and then either learned a homogeneous A-C list, a mixed list containing carried-over A-B and A-C pairs, or served as a rest control group. Immediately after the interpolated activity, retention of those A-B items which conformed to the A-B, A-C paradigm in both mixed and homogeneous lists was measured by modified method of free recall (MMFR). The mixed-list group gave more interlist intrusions during interpolated learning than did the homogeneous-list group but showed better retention. These results argue against the use of interlist intrusions as an indicant of extinction of specific S-R associations.

294. Pender, Nola, J. A developmental study of conceptual and acoustical dimensions and encoding categories in short-term memory. Paper presented at the AERA Meeting, Minneapolis, Minesota, 1970.

Using Wickens' release from PI technique with 2nd and 7th graders and adults, she found there was little difference in semantic encoding as a function of age. The children encoded much more acoustically than the adults. (Trip Report by Dr. George Marsh.)

295. Pollack, Gloria. Effects of ambigous conceptual similarity on retroactive interference in verbal memory. *Journal of Experimental Psychology*, 1969, 80(1), 171-174.

A list of nouns that are simultaneously flowers and girls' names was presented as an interpolated list (IL) to see how much retroactive interference (RI) was exerted over two previous original lists (OL), one of flowers and one of girls' names. Its effects were compared with those of an IL composed of either flowers or girls' names alone. Most of the RI of the flower list went to the previous flower list and most of the RI of the girls' names went to the previous girls' name list. The RI of the name-flower list split between the two OLs. The results suggest increased RI with increased conceptual similarity and that the ambiguous flower-name list is coded both in the flower and girls' name classes.

296. Pollio, H.R. Some semantic relations among word-associates. *American Journal of Psychology*, 1964, 77, 249-256.

A recent compilation of mean semantic differential ratings for a number of Kent-Rosanoff stimulus-words and many of their respective associative responses permits an examination of some semantic relations among word-associates. The results of four analyses have shown that:

1) There is a significant and positive correlation between the semantic differential rating of a stimulus-word and the semantic differential rating of that word's primary associate.

2) Correlations of this type are higher for word-associates produced by children than for word-associates produced by adults.

3) For adults, the magnitude of these correlations is related to the communality of the primary associate, such that correlations for high communality word-pairs are essentially zero, while the comparable correlations for low communality pairs are all significantly different from zero.

4) The magnitude of the intra-hierarchy distance of associative hierarchies evoked by negatively evaluated stimulus-words is greater than the intra-hierarchy distance of associative hierarchies evoked by positively evaluated stimulus-words.

297. Pollio, H.R., & Christy, E.G. Variation of inter-item associative strength and some measures of free recall. *Psychological Reports*, 1964, 15, 527-534.

Three groups of 20 Ss each were asked for the free recall of three different lists of 28 meaningful English words. Each list contained the associative responses evoked by a different Kent-Rosanoff stimulus word, and different in the amount of its inter-item associative strength (IIAS). The words in a given list also differed in terms of the number of other words (Nc) in that list producing or cueing that word as an associate. Results showed that the number of items appearing in free recall was a non-monotonic function of IIAS. For two of the three word sets, Nc was positively correlated with the frequency of

recall of individual items; while for the third set Nc value and frequency of recall were negatively correlated. The relationship between Nc and order of recall was non-linear, and some tendency toward alternating the recall of high and low Nc words appeared in the data. Thus, IIAS produced both facilitation and interference effects on free recall, the latter being the result of a factor similar to verbal satiation.

298. Pollio, H.R., Kasschau, R.A., & DeNise, H.E. Associative structure and the temporal characteristics of free recall. *Journal of Experimental Psychology*, 1968, 76(2), 190-197.

6 different groups of about 30 Ss each were required to recall 2 different lists of 22 words after having seen the list for 1, 3, or 5 presentations. 1 list contained 22 word associates evoked by the stimulus MUSIC, while the 2nd contained 22 word associates evoked by COMMAND. Since Ss produced their recalls orally it was possible to define Fast and Slow recall sequences on the basis of interword-response times (IRT). The words composing a fast output sequence were associatively more interconnected and semantically more similar than words composing a slow output sequence. These results imply that Ss make use of associative structure in facilitating recall, where such structure is based both on word association and semantic factors. Results were also discussed in terms of the various strategies used by Ss in accomplishing free recall.

299. Pompi, K.F., & Lachman, R. Surrogate processes in the short-term retention of connected discourse. *Journal of Experimental Psychology*, 1967, 75(2), 143-150.

A training list of words was presented in a meaningful syntactic order or in random order. In Experiment I, a recognition test was administered containing an equal number of distracter words of high or low thematic association (TA). The TA words were preselected by judges. In Experiment II, the TA words were interpolated between training and a free-recall test. Predicted interactions between Word Order and TA were obtained in both studies. The results suggest that the meaning of connected discourse may be stored as surrogate structures (themes, images, schemata, and words) and that lexical associations to the surrogate system may occur during retrieval.

300. Posner, M.I. Short term memory systems in human information processing. *Acta Psychologica*, 1967, 27, 267-284.

In this paper, three aspects of the role of memory in information processing have been considered. Retention of images, preservation of verbal information over brief periods, and reactivation of material from long term store represent different senses in which the term STM has been used. The assumption that all of these involve a single system may be fruitful for some purposes, but may also lead to inappropriate generalizations. For example, it does not appear that imagery need be short term or that reactivated information is especially susceptible to interference. Nevertheless, a considerable amount is now known about each of these systems and both comparisons and contrasts may prove useful.

301. Posner, M.I., & Konick, A.F. On the role of interference in short-term retention. *Journal of Experimental Psychology*, 1966, 72(2), 221-231.

In a series of experiments the similarity between items presented on a given trial (II) and on successive trials (PI) is systematically manipulated in conjunction with the difficulty of the information processing interpolated between presentation and recall. The results of the studies indicate that under conditions where forgetting proceeds independently of the effects of interpolated task similarity it depends upon similarity among stored items and upon the difficulty of the interpolated processing. The effectiveness of interference does not appear to vary directly with the difficulty of interpolated processing but is more closely related to the time material is in store. These results are compatible with the view that interfering items work spontaneously during the retention interval to disrupt the original trace (Acid Bath) rather than merely competing at the time of recall.

302. Postman, L., & Stark, Karen. The role of associative mediation in retroactive inhibition and facilitation. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 790-798.

The role of implicit mediating responses in producing retroactive inhibition and facilitation (RI and RF) was investigated. The degree of associative connection between the stimulus terms in successive paired-associate lists was varied. In Experiment I the response terms in the first and second list were different and unrelated. There was no evidence of mediated interference in either the transfer or the recall stage. Negative transfer and RI were substantial when the stimuli were identical. In Experiment II the responses in the two lists remained the same. Both mediated facilitation and RF were found. Potential mediators appear to be activated only when they facilitate performance.

303. Poteat, Barbara, W.S., & Kasschau, R.A. Generalization in short-term recognition of auditory verbal stimuli. *Psychonomic Science*, 1969, 17(6), 358-359.

Groups of second-, fourth-, and sixth-grad school children were asked to indicate whether or not each of 81 words being presented aurally had been presented previously. Using this short-term recognition task, verbal generalization to words related antonymically, synonymically, and phonetographically to the critical repeated word was demonstrated. Generalization was greatest for phonetographically related words.

304. Preusser, D., & Handel, S. The free classification of hierarchically and categorically related stimuli. *Journal of Verbal Learning and Verbal Behavior*, 1970, 9, 222-231.

Two experiments investigated the free classification of sets of three stimuli selected from two conceptual hierarchies. In Experiment I, one pair of stimuli was hierarchically related, one pair was categorically related, and one pair was unrelated. The Ss usually classified each set into two groups using the hierarchical or categorical relationship. The similarity between stimuli on each relationship influenced which of these relationships was used for classification. In Experiment II, different stimulus sets were used which varied the number of hierarchically related, categorically related, and unrelated stimulus pairs. As in Experiment I, classification was relational, and similarity influenced the choice of relationship. In addition, the relationship between stimuli in different groups affected classification. An explanation based on associative relatedness was not satisfactory.

305. Puff, C.R. Clustering as a function of the sequential organization of stimulus word lists. *Journal of Verbal Learning and Verbal Behavior*, 1966, 5, 503-506.

This experiment was designed to investigate the amount of clustering and the amount of recall as a function of the sequential organization of the stimulus list. The stimulus list contained 10 words from each of three taxonomic categories and was arranged so that there were either 0, 9, 18, or 27 category repetitions in the serial order of presentation. Lists at each level of organization were presented once to a total of 15 Ss for free recall. The results showed that the number of words recalled increased as a linear function of the organization of the stimulus list, while the amount of clustering increased as a more positively accelerated function. These results were interpreted as being generally consistent with a rationale based on the priming of common mediating responses.

306. Quaintance, Barbara, & Shapiro, S.I. Class membership and clustering in free-recall learning. *American Psychological Association, Annual Meeting Proceedings*, 1968.

Four experimental lists were constructed, each consisting of 16 normative restricted association stimuli and one response to each of them. Thus each list consisted of 32 words, containing 16 pairs of words related by one of four kinds of class membership.

All words were presented by means of a Carousel slide projector which was modified to automatically present each word for 1 sec. with 1-sec. interval between exposures. The recall periods were each 2 min. The Ss were instructed to write down as many words as they could recall and told that the order of recall was unimportant. They were also informed that there would be several trials.

The results of this study clearly indicate that the class membership of coordinates, superordinates, and contrasts all provide a basis of category clustering in free recall, as does the more extensively investigated relationship of subordinates (e.g., Bousfield, 1953). Equally clearly, however, the class membership of subordinates does result in the greatest amount of clustering, followed by coordinates and then by superordinates and contrasts.

307. Raxran, G. Semantic and phonetographic generalizations of salivary conditioning to verbal stimuli. *Journal of Experimental Psychology*, 1949, 39, 642-652.

1. Salivary CR's were formed in eight adult human Ss to 12 different English words.

2. After the CR's were well established, they generalized, in varying amounts, to 32 English words related to the conditioned words semantically, phonetographically, or both--the generalization being greatest from 'take' to 'took,' 72.6 percent, and smallest from 'mock' to 'match,' 8.1 percent.

3. A crude gradient manifested itself in the generalization to the phonetographically related words, the generalization being crudely a function of the number of common phonemes and common letters between the generalization and the conditioned words.

4. In the semantic categories (synonyms were not used in this experiment), the generalization was greatest to contrasts, coordinates, and subordinates of the condtioned words.

5. The generalization to supraordinates of conditioned words was only about one-half of the generalization to the subordinates of these words, and there was surprisingly little generalization from the first to the second word in a compound of two words (Yankee Doodle, mineral water).

6. The discrepancy between the last finding and what is generally known about habit and association has led to the formulation of a 'subsequent testing situation' hypothesis of CR generalization, according to which, CR generalization develops not during the original training to the conditioned stimuli, but during the subsequent testing for the generalization stimuli, and the direction of the CR generalization is thus determined not by the relatedness of the generalization stimuli to the conditioned stimuli, but by the relatedness of the conditioned stimuli to the generalization stimuli.

7. The 'subsequent testing situation' hypothesis of CR generalization accounts well for the results of the present study inasmuch as, in accordance with it, the supraordinates of the study were really subordinates and the subordinates were supraordinates, and inasmuch as the presentation of the second word of a compound of two words as a generalization word needed the invoking of backward association to be effective. The hypothesis has also a law of parsimony advantage over the 'original CR training' hypothesis inasmuch as it need not make extra assumptions about the 'spread' or 'irradiation' of CR generalization effects.

8. The 'subsequent testing situation' hypothesis of CR generalization was specifically tested by a supplementary experiment in which two Ss were conditioned to the second words of compounds of two words (Doodle water) and the first words (Yankee, mineral) were presented as generalization words. The results bore out fully the hypothesis, as the generalization CR's were now 57 and 49 percent, respectively.

9. A view is expressed that so-called primary stimulus generalization cannot be considered as something that has been defintely established either in the Russian laboratories or in any laboratory in this country.

308. Reicher, G.M., Ligon, Elizabeth, J., & Conrad, Carol, H. Interference in short-term memory. *Journal of Experimental Psychology*, 1969, 80(1), 95-100.

Two experiments investigated the locus of the effects of acoustic similarity in short-term memory. In the first, acoustic similarity of words making up the to-be-remembered list was varied independently of the acoustic similarity between the correct and incorrect response alternatives. The results indicate that Ss are more likely to choose the alternative which is similar to the greatest number of items in the list. A second experiment using a one-alternative yes/no procedure attempted to insure that the effects were not due to a guessing strategy and to allow the use of the signal detectability measure of sensitivity. Similarity within the list was shown to increase both hit and false-alarm rates resulting in an overall loss of sensitivity.

309. Reid, L.S., Brackett, H.R., & Johnson, R.B. The influence of relationships among items to be recalled upon short-term retention. *Journal of Verbal Learning and Verbal Behavior*, 1963, 2, 86-92.

Four experiments are reported in which Ss were required to remember familiar English words until their recall was requested. While remembering these words, Ss were presented other words or asked to recall previously presented items. In all four experiments, the recall of more than one item at a time was typically required. The studies are concerned with the manner in which short-term retention is influenced by the relationships among words whose recall is requested at the same time. It was found to make little difference whether the same or different Ss were responding under the various conditions of opportunity to group. Moreover, if the opportunity to group is varied in a stepwise fashion from the condition in which maximum grouping is possible to the condition in which S is required to remember only unrelated words, retention scores are found to be ordered with respect to this variation. However, it is interesting to note that under the task conditions of these experiments, retention is benefited by multiple-item recall, i.e., increased average load reduction, even when the items being recalled are unrelated. While it is possible that these benefits may have been derived in part from the grouping of unrelated items at recall, it seems more likely that the improvement was due to a decrease in retroactive inhibition that resulted from the concomitant decrease in number of interpolated recall points with increases in average load reduction.

310. Reiss, P. Rhyming the conceptual relationships in a free-recall task with retardates. *American Journal of Mental Deficiency*, 1968, 73, 81-85.

Adolescent educable retardates were presented three 20-item lists consisting of five words from each of four categories. There was a list of associatively-related words, one of rhymed-related words, and a mixed list. The first two lists were presented clustered, the third randomized. Each list was presented in a different random order on each of five trials.

Clustering and recall scores were highest for associatively related words and lowest for rhymed words, with the mixed list intermediate. Rhyming did not facilitate recall or clustering in mentally retarded Ss.

311. Richardson, J. The relationship of stimulus similarity and number of responses. *Journal of Experimental Psychology*, 1958, 56, 478-484.

This study varied the number of different responses and the similarity of the stimuli in relation to the responses in paired-associate lists. In 16-item lists either 2, 4, or 8 nonsense syllables were used as responses and either high- or low-similarity adjectives were used as stimuli. The similarity of the stimuli which had the same response was varied.

It was found that similarity was a variable in learning and that the list with a single response for each group of similar adjectives showed high positive intralist transfer characteristics of concept learning. Retention did not seem to be related to similarity, but was uniformly high.

312. Roberts, D.M., & Randhawa, B.S. Effect of concept grouping and dominance level on free recall. *Psychonomic Science*, 1969, 16(4), 198-199.

Lists of words were developed from Underwood & Richardson's (1956) verbal concept formation materials that would vary (1) in terms of their overall dominance level, and (2) whether or not words within lists were related to the same adjective concept. In administering these lists in a repeated measures design, no main effects (dominance level or concept grouping) were found, but a highly significant interaction resulted. It appears that concept grouping of words into lists only facilitates words of low dominance level.

313. Roberts, W.A. Alphabetic coding and individual differences in modes of orgnaization in free-recall learning. *American Journal of Psychology*, 1968, 81, 433-438.

Fifty-five Ss were read a list of 36 words in a different random order on each of 10 trials with a free-recall test after each trial. The list contained words of low interitem associative strength which could be grouped, on the basis of their first letters, into six sets of six words each. At the end of Trial 10, Ss were asked for written reports of all organizational strategies used in learning this list. Analysis of these reports revealed eight different types of strategies which Ss used in learning and recalling the list. Alphabetic clustering increased over trials, and the degree of clustering was directly related to the extent to which Ss reported using an alphabetic code. It was concluded that clustering may occur in the absence of interitem associations.

314. Roberts, W.A., & Smith, Ina. The effects of categorization and categorical repetition on successive recalls of word lists. *Psychonomic Science*, 1966, 5(6), 225-226.

The hypothesis that Ss develop a set to organize words by categories which facilitates recall was tested by measuring successive recall under conditions of high and low list-categorization. High categorization led to improvement in recall while low categorization did not, but the improvement under the high categorization condition appeared only when different categories were used in each list. When the same categories appeared on each list, high categorization produced no better performance than low categorization, and thus finding was attributed to proactive interference.

315. Robinson, Gail, & Loess, H. Short-term retention of individual paired associates as a function of conceptual category. *Journal of Experimental Psychology*, 1967, 75(1), 133-135.

The effect of conceptual category on short-term retention of paired-associates (A-Bs) was tested by utilizing Murdock's (1963) method of presenting a list for a single trial and then testing for the B member of one pair. For different conditions the A members, or the B members, or both, represented a single category. For a control condition, A's and Bs were unrelated words. 90 Ss were tested under all conditions, at all serial positions. The results of the control condition duplicated Murdock's (1963) findings of a marked recency effect. For the experimental conditions, only when A and B words of a given pair were from the same category and each pair was from a

different category did retention differ significantly from the control. As expected, overt intrusions were largely specific to the conceptual category of the response term.

316. Robinson, J.A. Category clustering in free recall. *Journal of Psychology*, 1966, 62, 279-285.

A list of 30 nouns drawn from 10 nonexhaustive categories was presented orally to 89 Ss five times. A three-minute written recall period succeeded each presentation of the list. The data were scored for (a) number of categories recalled on each trial, (b) number of items correctly recalled on each trial, and (c) amount of item clustering. The protocols of 20 Ss who showed perfect item clustering in recall on trials four and five were analyzed for evidence of category clustering. Category-transition matrices were prepared for each of these Ss and the number of recurrent, contiguous, category pairs was determined. Examination of the specific items linking the categories yielded a four-fold classification of presumed category-transition processes. Each of these processes was briefly disucssed.

317. Rohwer, W.D., Jr., & Levin, J.R. Action, meaning, and stimulus selection in paired-associate learning. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 137-141.

The task of learning 12 pairs of high-frequency nouns by a study-test method was given to 112 fifth-grade children. In the experimental conditions, the study trial consisted of the presentation of each pair in the context of a three-word sentence wherein the two nouns were connected by a verb. In a three-way design, the variables manipulated were: the amount of overt activity implied by the verbs (action vs. still); the meaningfulness of the sentence (normal vs. anomalous); and the character of the test-trial stimuli (subject nouns vs. verbs vs. subject nouns and verbs). Performance did not vary as a function of the amount of activity implied by the verbs, but normal sentences produced significantly more learning than anomalous ones. Verbs proved inferior to subject nouns as test stimuli, leading to the conclusion that the selection of verbs as functional stimuli during the study trials does not account for the sentential facilitation of noun-pair learning.

318. Rohwer, W.D., Jr., & Lynch, S. Form class and intralist similarity in paired-associate learning. *Journal of Verbal Learning and Verbal Behavior*, 1967, 6, 551-554.

Eight paired nouns were learned by 112 sixth-grade Ss under one or another of seven different experimental conditions in which the task was administered by a study-trial, test-trail method. On every study trial, each pair of nouns was presented in the context of a grammatical string of words and the experimental conditions were distinguished by differences in the composition of these strings. The form class of connectives was varied by comparing conjunctions, prepositions and verbs, and the intralist similarity of the strings was varied by manipulating the number of different words used as connectives within a list (two vs. four vs. eight). Preposition and verb connectives produced more rapid learning than conjunctions, regardless of the number of different connectives used. Thus, intralist similarity was rejected as an explanation of the inferiority of conjunction strings.

319. Rosenberg, S. Associative factors in the recall of connected discourse. *Psychonomic Science*, 1966, 4, 53-54. (a)

Two passages, one of which contained words of high associative strength and the other words of low associative strength, were presented once by tape recorder and followed by a written recall test. On all measures of recall, performance in the high association group was superior to performance in the low association group. The results of a cloze test suggested that guessing may have contributed more to recall scores in the association group than the low association group.

320. Rosenberg, S. Recall of sentences as a function of syntactic and associative habit. *Journal of Verbal Learning and Verbal Behavior*, 1966, 5, 392-396. (b)

The effects of syntactic (grammatical and ungrammatical word order) and associative (high, moderate, and low free-association strength) relationships between words upon performance in a sentence-recall task were studied. A 3 x 2 factorial design was used, and Ss in each group were exposed for 4 trials to a list of short sentences in a group-testing situation. Recall was facilitated by grammatical word order and by strong associative relationships between words. Recall of sentences that were designed to arouse a moderate level of associative habit, however, was poorer than had been anticipated. None of the interactions were significant. Syntactic errors were more prevalent in the recall of ungrammatical sentences than in the recall of grammatical sentences, and

intrusion errors occurred more frequently in the recall of sentences of moderate and low associative habit than in the recall of high-strength associative sentences. There was also evidence to suggest that the relationship between recall and sentence position for the group in which grammatical word order and high associative strength were combined was different from what it was in all other groups.

321. Rosenberg, S. Word associations and connected discourse: A reply to Lachman, Dumas and Guzy. *Psychonomic Science*, 1966, 5(6), 249-250. (c)

In this article, the author replys to criticisms made of certain aspects of the interpretation and procedure of a study on associative factors in the recall of connected discourse. Methodological considerations and the results of new research lead the author to suggest again, that pre-exerimental associative habits contributed to recall scores in the original study.

322. Rosenberg, S. Association and phrase structure in sentence recall. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 1077-1081. (a)

The effect of within- and between-phrase normative controlled association and phrase structure upon word integration in sentence recall was studied in two experiments. The two experiments differed only with respect to type of two-phrase sentence used. In both experiments, one group of Ss was given 4 study-test trials on a list of 4 sentences containing associatively related words, while another group received a list containing associatively unrelated words. On the assumption that an integrated unit is one in which adjacent words are recalled together, the probability of a word-to-word transitional error (TE) was used as a measure of the tendency to integrate the words within the sentences into larger units. In both experiments, the results suggested that the words in low association (LA) sentences are recoded into phrase units, but that the words in high association (HA) sentences are recoded into units that transcend the phrase boundary. The results indicated further that the probability of a TE at the phrase boundary decreases as associative strength across the phrase boundary increases. In addition, the probability of a TE within phrases was higher for LA sentences in Exp. II for the HA sentences. However, in Exp. I, association did not influence TE probability within phrases.

323. Rosenberg, S. Associative facilitation in the recall and recognition of nouns embedded in connected discourse. *Journal of Experimental Psychology*, 1968, 78(3), 254-260. (b)

This study was designed to test the hypothesis that associatively related nouns embedded in connected discourse--at least in the case of items that appear in the same or in contiguous sentences--are stored more efficently than associatively unrelated nouns. A 2 x 2 factorial design was employed (with 20 Ss in each group) in which Ss were asked to memorize a passage than contained associatively related nouns or a passage that contained associatively unrelated nouns. After a single exposure to a passage, retrieval was tested by a written recall test or by a paced successive binary recognition-memory test that was designed to greatly reduce opportunities for construction. The context of the high-association (HA) passage was the same as the context of the low-association (LA) passage. The hypothesis was supported: the facilitating effect of association was independent of retrieval method.

324. Rosenberg, S. The recall of verbal material accompaning semantically well-integrated and semantically poorly-integrated sentences. *Journal of verbal Learning and Verbal Behavior*, 1969, 8, 732-736.

This study tested the hypothesis that the recall of verbal material (critical material) accompaning semantically well-integrated (SWI) sentences will be superior to the recall of verbal material accompaning semantically poorly integrated (SPI) sentences. Complex sentences were constructed which contained two underlying sentences: a matrix sentence and an embedded sentence. Under the SWI condition, one underlying sentence was an SWI string, while under the SPI condition one was an SPI string. The critical material (identical for both levels of semantic integration) was contained in the second underlying sentence. The location of the critical material (i.e., whether it was the matrix or the embedded underlying sentence) was varied. A list-learning study-test procedure was used with 5 trials. The results indicated superior recall for the critical material under the SWI condition, and were interpreted in terms of a storage hypothesis.

325. Rosner, Sue, R. Serial mediation: Effects of associative strength and structure on serial learning and transfer. *Journal of Experimental Psychology*, 1970, 84(2), 370-372.

Serial mediation (of college students) was examined by studying the effects of intralist associative strength and structure on serial learning (SL) and on serial to double-function paired-associate (PA) transfer. Experimental Ss learned one of four serial lists, which varied in the degree or the arrangement of associative strength between adjacent items, and then practiced a PA list based on the same serial list. Control Ss practiced one of these PA lists after SL of a CVC list. The major findings were: (a) SL was affected by associative strength level; (b) PA performance was higher for experimental than control Ss; (c) intertask transfer was low; and (d) relative transfer was unaffected by the associative characteristics of the lists. The results suggest that mediation occurs in SL.

326. Ross, S., Yarczower, M., & Williams G.M. Recognitive thresholds for words as a function of set and similarity. *American Journal of Psychology*, 1956, 59, 82-86.

Ten 'set' words, peculiar to his assigned group, were presented tachistoscopically to each S. The words were then repeated. The order was randomized for each presentation and the words were shown individually at a suprathreshold value, arbitrarily selected at 0.60 sec. S was asked to write each word, as it was presented on the back of his data-sheet.

The test-words of the five experimental groups were given as follows: Group 1 (Practice) received five of the words appearing in the 'set' list; Group 2 (Similar) received homonyms of five of the 'set' words which were characterized by having only one more letter than the corresponding 'set' word; Group 3 (Intermediate) received five homonyms of the 'set' words, which were judged to be of intermediate similarity to the corresponding 'set' words; Group 4 (Dissimilar) received five homonyms of the 'set' words which were judged to be dissimilar to the corresponding 'set' words; and Group 5 (Control) received five new words, which had no predetermined connection with the 'set' words. The test-words were presented to each S in random order.

In terms of our original hypotheses we find that the preparatory set did facilitate the recognition of specific visual patterns. The recognitive thresholds as a function of structural similarity did not yield a monotonic function as we hypothesized. These results would indicate that the greater recognitive thresholds could not be attributed to interference responses, as defined.

In light of the previous observations, the hypothesis is ventured that the continuum underlying the perceptually similar elements is a complex one with length of word and number of identical elements contributing a significant portion of the variance of the recognitive thresholds for the test-words. The effect of this similarity continuum on recognitive thresholds in tachistoscopic experiments is counfounded by interference effects and by possible changes in response probability.

327. Rossi, E. Development of classificatory behavior. *Child Development*, 1964, 35, 137-142.

Bousfield's "associative clustering method" was used to study the development of classificatory behavior. Three groups of children--5, 8, and 11 years of age, respectively--were administered a 20-word stimulus list made up of five words from each of four different categories. For half of the subjects at each age level, verbal mediating terms were included. No deviation from linearity in the relation between age and clustering was found; nor did the presence of verbal mediators appear to facilitate clustering. The importance of difficulty level of stimulus material for demonstrating both the effectivness of verbal mediators in clustering and the existence of discriminable developmental stages in classificatory behavior is discussed.

328. Rotberg, Iris, C., & Woolman, M. Verbal paired-associate learning as a function of grouping similar stimuli or responses. *Journal of Experimental Psychology*, 1963, 65(1), 47-51.

Verbal paired-associate learning was measured when similar or dissimilar stimuli were grouped, and when similar or dissimilar responses were grouped. The following measures were employed: number of correct responses; type of errors made, i.e., errors indicating confusion between similar items and those indicating confusion between dissimilar items. The results indicated that learning was better when groups of stimuli were composed of similar items rather than dissimilar ones. The findings were interpreted in terms of discrimination and coding of the similar items.

329. Rothkopf, E.Z., & Coke, Esther, U. The prediction of free recall from word association measures. *Journal of Experimental Psychology*, 1961, 62(5), 433-438.

It was hypothesized that the frequency of recall of a given word W in a free recall situation depends directly on the number of cues which are provided by other words in the list. The cue number of word W was defined as the number of words in the learning list for which W is normally given as an association response in a word association test. The hypothesis was tested by exposing Ss (N = 28) to each of 99 words of the Kent-Rosanoff list for 5 sec. and testing for recall after 15 min.

The data supported the following conclusions: (a) The frequency with which a word was recalled was an increasing function of its cue number. (b) The frequency with which a word was recalled immediately after one of the words for which it was an association response (cue linkage) was an increasing function of its cue number even when the effects of recall frequency and chance differences due to cue number were taken into account. (c) Words which followed one of their cues in recall tended to be among those.

330. Rouse, R.O., & Verinis, J.S. The effect of associative connections on the recognition of flashed words. *Journal of Verbal Learning and Verbal Behavior*, 1962, 1, 300-303.

The effect of associative bonds on the recognition of flashed words was the concern of this series of experiments. The Ss were given one word to fixate and a second word was flashed in the same place at increasing durations. In some cases the flashed word was associated with the fixated word (the strength of the association was varied in two experiments), in others it was not. The results proved conclusively that association does facilitate the recognition of the flashed word. In every case the recognition time of associated test words was significantly less than that of nonassociated test words. The results are attributed to a general associative set which activates a large number of associates, enabling the S to guess the flashed word with only a partial perception. If the pair is nonassociated, the flashed word is not among those activated, so recognition is not aided but hindered.

331. Runquist, Peggy, A. Clustering in free recall following paired-associate learning. *Journal of Experimental Psychology*, 1970, 83(2), 260-265.

The present experiment investigated the organization of stimulus and response terms into sets during paired-associate (PA) learning on the basis of similarity relationships among the stimulus terms. The criterion for organization was the occurrence of clustering in separate free recall tests for the stimulus and response terms following learning. The Ss learned PA lists consisting of categorized and noncategorized nouns as stimulus terms and unrelated adjectives as response terms. On the free recall tests following learning, the groups learning categorized lists showed clustering of the stimulus terms and clustering of the response terms on the basis of the conceptual categories to which the paired stimuli belonged. Both stimulus and response term clustering were increased when Ss learned the categorized stimulus terms prior to PA learning.

332. Runquist, W.N. Intralist interference as a function of list length and interstimulus similarity. *Journal of Verbal Learning and Verbal Behavior*, 1966, 5, 7-13.

Two experiments are reported in which list length and similarity between pairs of stimuli are manipulated in a factorial design. In a standard verbal learning situation it was shown that only list length affects the number of errors prior to the first correct response, while an interaction between list length and similarity occurs in performance following the first correct response. This interaction, which took the form of list length having an effect only with low similarity, also appeared in a second study using nonsense shapes in a categorization task in which response learning was eliminated. The results suggest that, in addition to response learning, association, and stimulus discrimination, a fourth phase involving the learning of the particular responses which go with the pairs of similar stimuli is involved.

333. Runquist, W.N. Effects of variable frequency of presentation on paired-associate learning as a function of interstimulus similarity. *Journal of Verbal Learning and Verbal Behavior*, 1967, 6, 470-475.

Four groups of Ss were run in a paired-associate task in which they learned to associate buttons with trigrams. Two groups had highly similar stimuli while for two groups the stimuli were dissimilar. For one group in each similarity condition, four of the eight pairs appeared three times on each trial. For the other group all pairs appeared once. The asymmetrical presentation frequency resulted in superior performance in both high- and low-similarity tasks, although the effect appeared somewhat later under high similarity. Facilitation occurred entirely after the appearance of the first correct response and was accompained by an increase in the proportion of overt errors among those items which were not presented more frequently.

334. Runquist, W.N. Formal intralist stimulus similarity in paired-associate learning. *Journal of Experimental Psychology*, 1968, 78(4), 634-641. (a)

3 experiments investigated several aspects of the relationship between performance in paired-associate (PA) learning and formal intralist stimulus similarity. Similarity was defined in terms of number and position of identical letters among all possible pairs of stimuli comprising the list. In Exp. I, similarity was varied in lists using only a single letter-position identity "rule." In Exp. II, lists were of moderate similarity, but varied in terms of number of rules and variability of the similarity among stimuli. In Exp. III, the sets contained 4 rules, but varied in similarity. Similarity produced some interference in homogeneous lists, but the amount of interference was greater when the stimuli had multiple rules and was less when the variability was high. The results were discussed in terms of coding by pronunciation vs. stimulus selection.

335. Runquist, W.N. Functions relating intralist stimulus similarity to acquisition performance with a variety of materials. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 549-553. (b)

In four separate experiments, Ss learned a perceptual-motor PA task with variations in degree of intralist stimulus similarity. Variations were in formal similarity of low-m CVC's synonymity of adjectives, associative overlap of Kent-Rosanoff stimuli, and semantic distance of words from the semantic atlas. A

strong inverse relation was obtained between acquisition performance and formal similarity, while the indices of meaningful similarity produced significant but lesser effects. Rated similarity was highly correlated with each of the various indices.

336. Runquist, W.N. Reversal vs. non-reversal re-pairing in categorized paired-associate lists. *Candian Journal of Psychology*, 1968, 22(4), 285-293. (c)

Three groups were given 6, 18, or 24 trials on a paired-associate list in which the stimulus terms consisted of two sets of four formally similar trigrams followed by 10 trials on a list in which half of the responses were repaired with similar stimuli and half with stimuli in the other set. The results showed consistent superiority for the items re-paired with similar stimuli both in List-2 acquisition performance and on MMFR tests given during learning. The results were considered relevant to two hypotheses: grouping of responses to similar items and unlearning of intralist interfering associations. No evidence of intralist unlearning was found.

337. Runquist, W.N. Positive and negative transfer resulting from formal similarity of stimuli. *Journal of Experimental Psychology*, 1969, 82(1), 129-135.

Transfer in A-B, A'-B and A-B, A'-B, paradigms was related to number and position of identical letters between A and A' terms. Compared with an A-B, C-B condition, positive transfer occurred only when A and A' terms shared two letters. Negative transfer was also restricted to situations where stimuli shared two letters. When letter identity was in the same position for all items, negative transfer did not appear until late in acquisition. The results, in general, do not conform to a stimulus generalization interpretation of transfer and suggest the involvement of possible mediational mechanisms in transfer due to formal similarity of stimuli.

338. Runquist, W.N. Acoustic similarity among stimuli as a source of interference in paired-associate learning. *Journal of Experimental Psychology*, 1970, 83(2), 319-322. (a)

The Ss learned one of three paired-associate lists in which the stimuli varied. For two lists, the stimulus terms consisted of two groups of three trigram words in which the first two letters were identical within a group. Words were chosen so that for one group, the vowel sound within a group was virtually

identical, while for the other group, it was different. In the third group, the stimuli within a group shared only the initial letter. The list sharing two letters was no more difficult than the list in which a single letter was shared if the additional letter was acoustically or phonetically different. Confusion errors among items in which stimuli shared two letters were more frequent than those in which stimuli shared a single letter only when the second letter was acoustically or phonetically similar. The results indicate that the initial encoding of stimuli is in terms of pronounciation and that interference results from similarity at that stage.

339. Runquist, W.N. Structural effects of letter identity among stimuli in paired-associate learning. *Journal of Experimental Psychology*, 1970, 84(1), 152-163. (b)

Six experiments investigated the effects of formal intralist stimulus similarity in paired-associate learning with CCC, low-m CVC, and high-m CVC stimuli. In one set of studies, lists were constructed so that each stimulus contained the same letter or letters in the same ordinal position. All positions were used. In a second set of experiments, identical letters were in different positions and were not shared by all stimuli. Both 8- and 13-letter lists were used. With CCC stimuli, formal intralist stimulus similarity had little effect, unless the letter identities were in different positions. On the other hand, high-m CVC stimuli produced increasing interference with increasing overall similarity, but the complexity of the letter positions had little effect. With low-m CVC stimuli, both overall identity and complexity of the positions retarded learning. Position per se did not produce systematic differences. The results are discussed in terms of interference among acoustically similar representational responses and difficulty of establishing stable discriminative functional stimuli.

340. Runquist, W.N., & Marshall, Mary Ann. Transfer, synonymity, and anticipatory interval in paired-associate verbal learning. *American Journal of Psychology*, 1963, 76, 281-286.

Three groups of Ss were run in an experiment on transfer in which nonsense-syllables were used as stimuli and adjectives as responses in a mixed list. Each S learn two lists, with the second list consisting of four new pairs and four pairs in which the stimuli were identical to those in the first list and the responses were synonyms of those in the first list. The first list was learned with a 2-sec. anticipatory interval and the second list at an interval of either 1, 2, or 4 sec. The experiment was replicated with high school Ss and college Ss.

Results showed significant positive transfer due to synonymity on the first trial, for the high school Ss at the 2-sec. interval for the college Ss at the 4-sec. interval. Overt errors were highest with a 2-sec. interval.

341. Ryan, J.J. Comparison of verbal response transfer mediated by meaningfully similar and associated stimuli. *Journal of Experimental Psychology*, 1960, 60(6), 408-415.

Similarity in connotative meaning and verbal habit strength as separate factors relating interlist stimulus words in subsequent paired-associate learning lists were compared as to their effectiveness in mediating response transfer across these lists. The Ss learned in sequence two paired-associate lists, an original and transfer list, and relearned the original list. Three types of verbal relationship were established between the corresponding interlist stimulus words paired for learning with the same response: Type A, representing maximal habit strength connections and low similarity in meaning; Type S, representing weak habit strength connections and maximal similarity in meaning; Type C (control), representing weak habit strength connections and low similarity in meaning. These interlist relations were obtained by pre-experimental selection of stimulus word pairs on the basis of appropriate norms for semantic distance (as derived from Osgood's semantic differential), which served as an index of similarity in connotative meaning; and free-association response frequency, which served as an index of verbal habit strength. Measures of performance on the transfer list showed that both Type A words and Type S words facilitated learning to a greater extent than the Type C control words and that the Type A words facilitated learning to a greater extent than the Type S words. No systematic differences in recall or relearning of the original list were obtained. It was concluded that both verbal habit strength and connotative similarity in meaning as relations between interlist stimulus words contribute independently to the mediation of response transfer and that the mediation effects contributed by verbal habit strength connections were as good if not better than those contributed by connotative similarity within the subset of words used here. The theoretical relevance of these two factors was presented and discussed.

342. Sachs, Jacqueline, S. Recognition memory for syntactic and semantic aspects of connected discourse. *Perception & Psychophysics*, 1967, 2(9), 437-442. (a)

This study investigates the pattern of retention of syntactic and semantic information shortly after comprehension of connected discourse. Ninety-six Ss listened to 24 taped passages and, after each passage, heard one recognition test sentence which was either identical to a sentence that had occurred in the passage, or was changed in some slight way. The Ss reponded "identical" or "changed," rated their confidence, and classified changes as "meaning" or "form." Two independent variables were manipulated: (1) The relationship between the original sentence in the passage and the test sentence. The test sentence was (a) semantically changed, (b) changed from active to passive voice or vice versa, (c) formally changed in other ways that did not affect the meaning, or (d) unchanged. Each sentence appeared in all change types. (2) The amount of interpolated material between the original and test sentences was zero, 80, or 160 syllables of connected discourse which was a continuation of the passage. Each S heard passages representing all levels of each variable. All combinations of particular passages, relationship of original and test sentence, and amount of interpolated material were tested.

When the test sentence was heard immediately after the original, retention was high for all test types. But after 80-160 syllables, recognition for syntactic changes had dropped to near chance levels while remaining high for semantic changes. Even when the meaning of a sentence was remembered, formal properties that were not necessary for that meaning were forgotten very quickly. The results suggest that the original form of the sentence is stored only for the short time necessary for comprehension to occur. When a semantic interpretation has been made, the meaning is stored. Thus the memory of the meaning is not dependent on memory of the original form of the sentence.

343. Sachs, Jacqueline, S. Recognition of semantic, syntactic and lexical changes in sentences. Paper presented at Psychonomic Society, October, 1967.

After listening to short passages, Ss attempted to detect changes in sentences from the passages. Changes in grammar or wording that did not affect the meaning were poorly detected after a few seconds, and substitution of a synonymous word was particularly difficult to detect. Results suggest a very rapid decay of memory for the perceived sentence after comprehension, and the later "recall" is a reconstruction from the remembered meaning.

344. Sales, B.D., Cole, R.A., & Haber, R.N. Mechanisms of aural encoding: V. Environmental effects of consonants on vowel encoding. *perception & Psychophysics*, 1969, 6(6A), 361-365.

To determine whether the accuracy of recall of vowels in short-term memory is affected by the distinctive features of preceding consonants, 25 Ss heard, at a rate of 1/sec. sequences of 5 consonant-vowel syllables, in which the middle 3 consonants shared either the same manner of articulation, the same place of articulation, or neither the same manner nor the same place. After a 3-sec. pause, they had to recall verbally all 5 syllables. While the distinctive feature makeup of the preceding consonants did not affect the overall accuracy of recall of the vowels, it clearly altered the types of intrusion errors made. Specifically, when all of the consonants share the same place of articulation, all distinctive feature systems tried can predict the errors with greatest accuracy, presumably because the vocal apparatus begins in the same place for each syllable. Other findings and their implications are discussed.

345. Sales, B.D., Haber, R.N., & Cole, R.A. Mechanisms of aural encoding: IV. Hear-see, say-write interactions for vowels. *Perception & Psychophysics*, 1969, 6(6B), 385-390.

Six vowel sounds were presented in random orders for recall from short-term memory. Four groups of 25 Ss each in a 2 by 2 design either heard or saw the words, and either had to say them or write them. In general, accuracy was greater when the sounds were seen rather than heard, especially when they were verbally reported. The major concern was the degree to which the major distinctive feature systems could predict the intrusion errors in each of the four conditions. The best prediction occurred in the auditory-imput/verbal-output condition, as would be expected from the models on which distinctive feature specifications are based. However, as in a previous study by these authors, the most accurate predictions were not always made by the same combination of distinctive features. It is concluded that distinctive features are identified in the initial encoding before any retrieval processes are activated and that further errors made at the time of retrieval are also related to distinctive features. Most importantly, however, both at initial registration and at retrieval, different features are implicated, depending upon the sound presented for recall and the input-output modalities involved.

346. Samuels, S.J. Effect of word associations on the recognition of flashed words. *Journal of Educational Psychology*, 1969, 60(2), 97-102.

When two words are presented in succession, what effect does reading the first word have on speed of recognition of the second word? It was hypothesized that when associated pairs of words were presented, speed of recognition would be faster than when nonassociated word pairs were presented or when a target word was presented by itself. Twenty college Ss recognized words under five treatment conditions in a counterbalanced design. The results supported the hypotheses, and under certain conditions recognition was at subthreshold speeds. A discussion of factors which influence speed of reading when reading meaningful connected prose is presented.

347. Samules, S.J. Effect of word associations on reading speed, recall, and guessing behavior on tests. *Journal of Educational Psychology*, 1968, 59(1), 12-15. (a)

A paragraph containing words with high-associative (HA) relationships should be read faster and with better recall than a similar paragraph containing words with low-associative (LA) relationships. Mean reading time for elementary school Ss in the HA condition was 43.82 sec. and 58.81 sec. in the LA condition ($p < .05$). The mean number of questions answered correctly for HA was 9.50 and 5.04 for LA ($p < .001$). When college Ss read the same paragraphs, the mean time was 35.26 sec. for HA and 38.26 for LA ($p < .01$). The mean number of questions answered correctly was 9.69 for HA and 6.87 for LA ($p < .001$). When required to guess the correct answer, control Ss chose significantly more often alternatives which contained words having HA relationships with words in the stem of the question. Results on reading speed are discussed in terms of the effect of word associations on perceptual factors in word recognition.

348. Samuels, S.J. Relationship between formal intralist similarity and the von Restorff effect. *Journal of Educational Psychology*, 1968, 59(6), 432-437. (b)

Experiment I: 60 1st graders were randomly assigned to either a high, medium, or low stimulus similarity paired-associate list. During learning trials 1 stimulus in each list was printed in red and the other stimuli were in black. Transfer trials were given after each 5 learning trials. During learning trials in the high-similarity list more ($p < .001$) correct responses were given to the stimulus in red. At transfer there was a reversal of significance, and fewer correct responses ($p < .02$) were given to the stimulus

formerly in red. On medium- and low-similarity lists the differences in correct responses to red and black stimuli were not significant at learning or at transfer. Experiment II: 30 college Ss learned a high stimulus similarity paired-associate list. During learning trials 1 stimulus was in red. The other stimuli were in black. On transfer trials all stimuli were in black. Learning and transfer trials were alternated. The results were similar to those found in Experiment I for the high-similarity list. It appears that magnitude of the von Restorff effect is influenced by stimulus similarity. Failure to find positive transfer for the stimulus formerly in red was discussed in terms of attentional factors in learning.

349. Samuels, S.J., & Jeffrey, W.E. Intralist similarity and facilitation of paired-associate learning by fixed order presentation. *Psychonomic Science*, 1966, 5(4), 141-142.

It was demonstrated that when intralist similarity is high, paired-associate learning proceeds faster with fixed order presentation than with varied order. When intralist similarity is low, fixed order presentation does not facilitate learning.

350. Samuels, S.J., Wittrock, M.C. Word-association strength and learning to read. *Journal of Educational Psychology*, 1969, 60(3), 248-252.

The effect of associative strength between adjective-noun word pairs on learning to read the second word of the pair was investigated. Thirty-six first graders took all four treatments in a 4 x 4 repeated-measures Greco-Latin square design. The word pairs in the control treatment had no associative connections, whereas in the other three treatments increasing amounts of associative strength between adjective and noun were conditioned. Following word-association training, reading training was given on the same word pairs learned during word-association training, followed by a word-recognition test on the second word of each pair. Word pairs having low-strength associations and also word pairs having high-strength associations facilitated reading when compared to word pairs with zero-strength associations ($p < .001$).

351. Scandura, J.M., & Roughead, W.G., Jr. Conceptual organizers in short-term memory. *Journal of Verbal Learning and Verbal Behavior*, 1967, 6, 679-681.

This study determined the effects on the STM of five noun lists of: (a) conceptual recoding cues (adjectives) presented prior to the lists, (b) list dominance (high, low, and no dom), and (c) retention interval (1, 5, 15, and 30 sec.). Number of nouns correctly recalled was a function of recoding cue, dominance level (high > low > no dom), and time. The recoding cues facilitated retention of the high and low dom lists, but depressed 1-sec recall of the no dom lists. There were relatively more within concept-category noun intrusions during high dom and recoding-cue recall than with their controls. Mean latencies between nouns correctly recalled were shorter at 1-sec recall than thereafter, but there were no other differences due to time, recoding cue, or dominance. These results, involving the reorganization of input, were interpreted in terms of a simple model postulating familiar and unfamiliar storage locations.

352. Schaeffer, B., & Wallace, R. Semantic similarity and the comparison of word meanings. *Journal of Experimental Psychology*, 1969, 82(2), 343-346.

Two experiments attempted to demonstrate the effects of semantic similarity on the judgment of word meanings. Experiment I showed that semantic similarity facilitated the judgment of meaning equivalence, e.g., the judgment that two words belong to the same category. Experiment II showed that semantic similarity hindered the judgment of meaning difference, e.g., the differentiation between the meanings of two words. Explanations of the effects in terms of associative biases and hierarchical processing are proposed.

353. Scheirer, C.J., & Voss, J.F. Reminiscence in short-term memory. *Journal of Experimental Psychology*, 1969, 80, 262-270.

Reminiscence in the short-term memory of single associations was studied in a series of six experiments. The data indicated that duration of interpair interval was the primary factor producing reminiscence, thus suggesting that reminiscence is attributable to interference from previously presented pairs. Another finding was that essentially no forgetting occurred after 8 sec., regardless of stimulus presentation duration or verbal material. The results were considered in relation to other studies which demonstrated reminiscence, and the findings also were related to three hypotheses involving the nature of the interference found in the present experiments. These

hypotheses were (a) classical interference, which attributes inference to the amount and similarity of material; (b) a two-stage processing hypothesis, which attributes interference to the first or processing stage; and (c) an acquisition hypothesis, which attributes interference to the influence of prior pairs on acquisition, not retention, of new pairs.

354. Schoer, L. Effect of similarity in structure, meaning, and sound on paired-associate learning. *Journal of Educational Psychology*, 1967, 58(4), 189-192.

The purpose of the study was to determine the effect of 3 types of stimulus similarity on paired-associate learning of 5th-grade Ss. 80 Ss learned each of 4 lists (total N = 320). The stimuli in List I were similar in meaning, those in List II in sound, and those in List III in structure. List IV was the control list. List III performance was significantly lower than that on the other 3 lists. None of the other list differences were significant. There was also a significant ability effect, but the interaction between lists and ability level was not significant.

355. Schulman, R.M. The effect of unidirectional primary word associations on A-B, C-A paired-associate transfer. *Psychonomic Science*, 1967, 8(8), 323-324.

A paired-associate transfer experiment compared 3 variations of the A-B, C-A paradigm to the A-B, C-D control. Four separate groups of 20 Ss each learned both lists to a criterion of one errorless trial. In two of the experimental groups, the stimulus of List II was the primary word association to the response of List I. These were more difficult to learn than the control, but easier than the A-B, C-A paradigm without the inter-list primary word-associations.

356. Schwartz, F., & Lippmann, F. Cognitive and associative structures in recall. *Psychological Reports*, 1962, 11, 91-101.

Ss (N = 154) were tested for immediate memory of 24 nouns embedded in six sentences. Three levels of sentence coherence and two instructions were used; the instructions directed Ss to learn the nouns or to learn the sentences. The results show that Ss remembered the sentences as units, facilitating recall, and tended to forget the sentences as units also. A reciprocal relationship was found between associative and sentence structure determinants of recall. The results were discussed in terms of the facilitating effects of organicational structures in memory and in terms of interference generated by competing modes of organization.

357. Schwenn, Elizabeth, A., & Underwood, B.J. The effect of formal and associative similarity on paired-associate and free-recall learning. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 817-824.

Associative similarity between pairs of words and formal similarity among consonant syllables were manipulated to determine their influences on free-recall learning (FL) and on paired-associate learning (PAL). The higher the formal similarity the slower the FL, while the higher the associative similarity the more rapid the FL. Increasing formal similarity among response terms in PAL was accompained by a linear performance decrement which increased with trials. Increasing associative similarity among response terms in PAL did not influence behavior, a consequence believed due to a cancellation of the negative effects on associative learning and the positive effects on response learning. Increasing formal similarity among stimulus terms in PAL resulted in first an increase in performance followed by a sharp decrease, suggesting that some postive factor for learning initially accompanies the increase in similarity. This factor was not identified. Increasing associative similarity among stimulus terms generally resulted in a decrement in learning but this relationship, too, was complex.

358. Segaiowitz, N., & Lambert, W.E. Semantic generalization in bilinguals. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 559-566.

Bilinguals were trained to press a reaction-time button to those words in a mixed-language (English and French) list which were not exemplars of a certain general concept while learning to recognize which words were. They were then tested on a new mixed-language list containing English and French synonyms of the concept, unrelated words, as well as the original training exemplars of the concept. Reaction latencies were used as indices of within- and between-language semantic generalization. It was found that: (a) all Ss generalized their responses significantly to both within-language and other-language synonyms; (b) in screening words for membership in the special category, Ss found that the semantic properties of each test word provided a more important clue than did the language of the test word; and (c) the semantic properties of test words played a more important role for coordinate than for compound bilinguals.

359. Shepard, R.N. Application of a trace model to the retention of information in a recognition task. *Psychometrika*, 1961, 26(2), 185-202.

A stochastic model is proposed to account for the behavior of subjects in recognition tasks in which stimuli are presented, on at a time, in a protracted sequence. The basic assumption is that the memory trace resulting from the presentation of a particular stimulus not only fades away during the presentation of subsequent stimuli but also "diffuses" in such a way as to become decreasingly stimulus specific. An account is thereby provided for both (a) the increase in the probability of false recognition with the total number of stimulus presentation (b) the departure of curves of forgetting from the previously proposed simple exponential decay functions. An expression for the amount of information carried along when the number of stimulus presentations becomes large is then derived for subjects who conform with the model.

360. Shepard, R.N. Learning and recall as organization and search. *Journal of Verbal Learning and Verbal Behavior*, 1966, 5, 201-204.

In conclusion, I no longer regard as tenable the uncomplimentary view of man as an essentially passive system in which arbitary connections are imposed, will he--nill he, by repeated applications of external reinforcement. On the contrary man is an active agent with a definite, hopefully decipherable, internal structure. The ubiquity of evidence for processes of searching, grouping, and ordering in recent studies suggests to me that these processes represent neither occasional lapses nor mere epiphenomena of this underlying structure. They represent, I believe, its fundamental modus operandi.

361. Sherman, P.S., & Brown, S.C. Effect of simultaneous presentation of conceptually similar and dissimilar items on paired associate learning. *Psychonomic Science*, 1969, 16(6), 319-320.

Paired-associate learning was retarded significantly when subsets of conceptually dissimilar pairs were presented simultaneously rather than successively for learning. The retardation was eliminated, however, when the subsets contained pairs sharing similar stimulus terms or similar response terms. Under both methods of presentation, learning was faster when pairs were grouped on the basis of conceptual similarity than when the same pairs were presented in dissimilar groupings.

362. Shiffrin, R.N., & Atkinson, R.C. Storage and retrieval processes in long-term memory. *Psychological Review*, 1969, 76(2), 179-193.

A theory of human memory is described in which a distinction is made between three memory stores: the sensory register, the short-term store, and the long-term store. Primary emphasis is given to the processes by which information is stored in and retrieved from the long-term store, a store which is considered to be a permanent repository for information. Forgetting and related phenomena are attributed to a failure of the retrieval process, in which the search through some memory area becomes less efficient as new information is placed in it. Storage and retrieval in the long-term store are conceived of as parallel processes, one mirroring the other, and each is divided into three stages for conceptual clarity. The memory trace is viewed as an ensemble of information stored in some memory location, the location of storage determined largely by the components of the ensemble itself. The ability of the system to cope with diverse phenomena is demonstrated by a consideration of a number of selected experimental paradigms.

363. Shima, F., & Hackbarth, S. Size and marking of associative units. Working Paper, May 20, 1970, Southwest Regional Laboratory, Inglewood, California.

The retention of connected discourse was examined as a function of the size and marking of embedded associative units. Six prose passages were made up differing only in the degree of association between embedded cue words, associative unit size, and marking of cue words. A total of 240 fifth grade children, in groups of 10-20, were given two and one-half minutes to read one of the passages, and immediately thereafter were given either cued or free recall sheets on which they were instructed to write the passage from memory. Size and marking of associative units had no effect, however, degree of association was significant. In opposition to Rosenberg's conclusions as to the source of high associative facilitation, it was found that the average size of chunks did not differ between groups, only the number of chunks. Therefore, the facilitation is apparently due to the increased probability of sequences being formed when highly associated words are embedded in connected discourse.

364. Shuell, T.J. Clustering and organization in free recall. *Psychological Bulletin*, 1969, 72(5), 353-374.

Research on clustering and subjective organization (SO) in free recall is reviewed and evaluated. Various indexes developed to measure clustering and SO are evaluated, and two intercorrelation matrices among clustering measures and the number of words recalled are presented. The existence of a large negative bias in the correlation between the ratio of repetition (RR) measure and recall is demonstrated. Various theoretical issues which have developed from the study of organization in free recall are presented and discussed.

365. Shuell, T.J. Retroactive inibition in free-recall learning of categorized lists. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 797-805.

Two successive lists of 35 nouns representing 7 conceptual categories were presented for 4 trials each. For half of the Ss different examples of the same categories appeared in the two lists; for the other half different categories were represented by the words in the lists. The experimental Ss recalled the words either immediately after learning List 2 or after a 20-min delay. One-third of the Ss recalled both lists at the same time, 1/3 recalled List 1 and then List 2, and 1/3 recalled List 2 before recalling List 1. Significant retroactive inhibition (RI) was obtained for both the Same and Different conditions, and the amount of RI was significantly greater in the Same condition. The RI in the Different condition resulted from the loss of whole categories while the RI in the Same condition resulted from the loss of both whole categories and specific words within categories. There was significantly less RI when both lists were recalled together than when they were recalled separately. Although there was a general increase in performance over the 20-min interval, there was no evidence of spontaneous recovery. It was concluded that the amount of RI obtained in free recall is directly related to the similarity of the organizational cues used for organizing the words into higher-order units.

366. Simon, H.A., & Feigenbaum, E.A. An information-processing theory of some effects of similarity, familiarization, and meaningfulness in verbal learning. *Journal of Verbal Learning and Verbal Behavior*, 1964, 3, 385-396.

Results obtained by simulating various verbal learning experiments with the Elementary Perceiving and Memorizing Program (EPAM), an information-processing theory of verbal learning, are presented and discussed. Predications were generated for experiments that manipulated intralist similarity (Underwood, 1953); interlist similarity (Bruce, 1933); and familiarity and meaningfulness. The stimulus materials were nonsense syllables learned as paired-associates.

A description of the EPAM-III model is given.

The predictions made by the model are generally is good agreement with the experimental data. It is shown that the quantitative fit to the Underwood data can be improved considerably by hypothesizing a process of "aural recoding."

The fit of the EPAM predications to data of Chenzoff (1962) lends support to the hypothesis that the mechanism by means of which a high degree of meaningfulness of items facilitates learning is the high familiarity of these items.

The effects of varying degrees of stimulus and response familiarization on ease of learning were studied, and are shown to be surprisingly complex.

367. Simon, S., & Hess, J.L. Supplementary report: Influence of inter-item associative strength upon immediate free recall in children. *Psychological Reports*, 1965, 16, 451-455.

Indices of inter-item associative strength were obtained on the basis of word association norms for 15 free recall lists consisting of 12 items each. Recall performance on these lists was found to be reliably related to the index of inter-item associative strength for 4th, 5th, and 6th grade children. Consistent with results reported by Deese (1959), it was found that, for all Ss, inter-item associative strength was positively related to the number of words recalled, negatively related to the number of extra-list intrusions, and positively related to the commonality of intrusions. In agreement with the experimental hypothesis, most of the coefficients reported by Deese for college Ss were higher than those obtained for grade school Ss.

368. Slamecka, N.J. Differentiation versus unlearning of verbal associations. *Journal of Experimental Psychology*, 1966, 71(6), 822-828.

Underwood and Postman (1960) theorized that learning of a list requires the unlearning of competing preexperimental associations to the list items. 3 experiments tested this assumption. Experiments I and II showed that obtained extralist and intralist preexperimental associations were not unlearned following the learning of one or two competing lists. Experiment III showed no weakening of natural associations after competing list learning, by latency measures. It was concluded that preexperimental associations were inhibited but not unlearned during list acquisition. The hypothesis was developed that strong associates are differentiated before they can be unlearned, and weaker associates are unlearned more rapidly than they can become differentiated.

369. Slamecka, N.J. Retroactive inhibition of connected disourse as a function of similarity of topic. *Journal of Experimental Psychology*, 1960, 60(4), 245-249.

It was hypothesized that the retroactive inhibition of the rote retention of prose passages was a positive function of the degree of similarity of topic the interpolated passage bore to the interpolated passage. Three levels of judged topical similarity were employed, and significant RI was obtained. The hypothesis was confirmed, thus verifying and extending the generality of previous findings. A tentative formulation stressing response competition and increased latencies was discussed.

370. Slamecka, N.J. Testing for associative storage in multitrial free recall. *Journal of Experimental Psychology*, 1969, 81(3), 557-560.

Experiment I had three alternate training and test trials of written free recall of 30 words presented in fixed order. On the third test trial, the random condition had 16 of these words on the recall sheet in random order. The serial condition had the same words listed in order of presentation, with Xs indicating the missing critical items. Controls had blank recall sheets throughout. Final critical item recalls were equivalent under all conditions. Experiment II had specific instructions about the nature of the final test. Final critical item recalls of both context conditions were inferior to the control because of the loss of previously recalled words between Trials 2 and 3. Since context did not aid recall, it was concluded that items were probably not stored associatively, but that instead they might be stored independently.

371. Slamecka, N.J. Transfer with mixed and unmixed lists as a function of semantic relations. *Journal of Experimental Psychology*, 1967, 73(3), 405-410.

Transfer effects with mixed list (ML) and unmixed lists (UL) were investigated under 5 paradigms: AB-AB, AB-ASyn (synonymous responses), AB-AAnt (antonymous responses), AB-ABr, and an AB-CD control. Results showed that for both ML and UL, the AB, ASyn, and AAnt paradigms produced clear-cut positive transfer. ABr produced mixed effects, attributable to different control levels. Direct comparisons of ML vs. UL data showed CD acquisition to be easier under ML, and the implications of this for transfer conclusions were drawn. A cognitive mediation hypothesis was rejected in favor of a semantically based response generalization mechanism.

372. Sperling, G. A model for visual memory tasks. *Human Factors*, 1963, 5, 19-31.

A model for visual recall tasks was presented in terms of visual information storage (VIS), scanning, rehearsal, and auditory information storage (AIS). It was shown first that brief visual stimuli are stored in VIS in a form similar to the sensory input. These visual "images" contain considerably more information than is transmitted later. They can be sampled by scanning for items at high rates of about 10 msec per letter. Recall is based on a verbal recoding of the stimulus (rehearsal), which is remembered in AIS. The items retained in AIS are usually rehearsed again to prevent them from decaying. The human limits in immediate-memory (reproduction) tasks are inherent in the AIS-Rehearsal loop. The main implication of the model for human factors is the importance of the auditory coding in visual tasks.

373. Sperling, G. Phonemic model of short-term auditory memory. *American Psychological Association, Annual Meeting Proceedings*, 1968, 63-64.

The twin concepts of memory for phonemes and of phonemic efficency of an alphabet yield good predictions of observed AS-deficits. Simple phonemic-inefficency of AS alphabets accounts for most of the adverse effect of acoustic similarity on recall.

374. Sperling, G., & Speelman, Roseanne, G. The effect on sound of stimuli on short-term memory. Memorandum No. 67-1223-9, August 25, 1967, Bell Telephone Laboratories.

1) Fourteen subjects performed 38 memory experiments for recall of spoken letters, using partical report, running memory span, and static memory span procedures. Stimuli were spoken at rates of 1, 2, or 4 letters per sec, and were composed either of letters that sounded different or letters that sounded alike. Visual memory span was tested at 3 exposure durations with stimuli composed of each alphabet. Intelligibility control test showed that all auditory stimuli were completely intelligible.

2) In all 22 auditory and visual procedures, subjects reported more letters correctly from sound-different stimuli than from sound-alike stimuli. Analysis of variance of the auditory procedures showed procedure and alphabets to be large effects, and also the following moderate effects: rates, alphabets x procedure, and rates x alphabets x procedure.

3) The performance deficit in the visual spam experiments when sound-different stimuli were replaced with sound-alike stimuli was equivalent to the deficit observed in the auditory static memory span procedures (at presentation rates of 1/sec and 2/sec). The one exception to this equivalence occurred at a visual exposure of 12 sec, where a subgroup of subjects, who reported using a pattern-seeking strategy, showed no deficit. When subjects use a rote rehearsal strategy, variation of visual exposure duration or of visual presentation rate produces results equivalent to the variation of list length in auditory presentations. Auditory memory thus limits performance even when stimuli are presented visually and responses are written. However, a different form of memory is clearly revealed at long visual exposure durations, or at very slow (1/3 sec) visual or auditory presentation rates.

4) Subvocal rehearsal of stimuli could be inferred from serial position effects in the data and from subjects' introspections. Rehearsal did not increase the capacity of short-term memory, either for sound-difference or sound-alike materials. It was concluded that rehearsed items share the same memory as unrehearsed auditory stimuli. Rehearsal may improve <u>performance</u>, however, by rearranging the contents of auditory memory in a form appropriate to recall.

5) Predications derived from the following principles correlate .98 with the results of the 38 auditory experiments. (I) The capacity of short-term auditory memory is 24 phonemes, equivalent to 7.31 sound-different letters plus 1 poststimulus cue. (II) Capacity for sound-alike letters is 1.79 letters smaller because noninformational phonemes occupy useful storage. (III) Auditory memory span equals capacity minus .74, 1.04, or 2.34 letters (corresponding to presentation rates of 1/sec, 2/sec, or 4/sec) because retriveal interferes with the contents of memory. (IV) Running memory span = 0.59 x memory span, reflecting inefficient storage and retrieval. (V) Static memory score equals the larger of (memory span, number of letters in stinulus) minus a correction for truncation (computed by assuming the population memory span is distributed normally with 0 = 1.2 letters).

6) Scoring for items--independent of their position--indicates an additional mean capacity of about 1.5 letters (i.e., without knowledge of position) which is independent of the alphabet, presentation rate, and list length.

375. Spreen, O., & Borkowski, J.G. Effects of abstractness, meaningfulness, and phonetic structure on auditory recognition of nouns. *Journal of Speech and Hearing Research*, 1966, 9, 619-625.

One-syllable words defined in an earlies study as to meaningfulness (m) and two measures of abstractness (c and s) with familiarity held constant were presented under masking noise conditions to 30 normal and 60 mentally defective subjects. High and low abstract words were matched for initial phoneme or phoneme blend. The results indicated that over-all recognition scores were not significantly related to intelligence and that high m and high c words were more easily recognized in both groups. The defective group showed a stronger relationship between c, s, and recognition than did the normal group, although statistical significance for this difference between groups was not obtained. Brain-damaged and cultural-familial defectives did not show a significant difference in the effect of these parameters. No significant relationship was found between the performance on Halstead's Cateogry Test and IQ or abstractness level of words. Initial phonemes affected recognition in a consistent pattern; the "phonetic hierarchies" for the two groups as well as those obtained in previous studies were similar.

376. Steinberg, D.D.C. Analyticity, amphigory, and the semantic interpretation of sentences. *Journal of Verbal Learning and Verbal Behavior*, 1970, 9, 37-51.

The empirical validity of the semantic sentence categories of Informative (synthetic), Redundant (analytic), Contradictory, and Amphigory (absurd, nonsensical) was assessed. In a sentence sorting task, each of 28 Ss stored 156 sentences solely on the basis of examples given for the four postulated categories. The results strongly support the validity of the semantic categories. An account of the competence underlying Ss' ability to interpret sentences with respect to such categories is proposed. This account is based on such notions as semantic features, a hierarchy of semantic dimensions, rules of semantic interaction, and rules of sentence interpretation.

377. Steinberg, D.D.C. The effects of meaningful similarity and practice in the transfer of training. *Dissertation Abstracts*, 1966, 27(68), 2171.

This study investigated the effects of two variables within a transfer of training paradigm. The findings of this research are interpreted with a view to assessing Osgood's theory of transfer for Paradigm B which predicts that the more nearly similar are two responses, the less would be the interference in learning. The two variables, Meaningful Similarity relations and amount of original list practice, were introduced in a transfer paradigm where the responses of two lists are varied and the stimuli are the same, i.e., Original list (OL): S_1--R_1; Transfer list (TL): S_1--R_2. The stimuli were letter pairs, and the responses, adjectives, e.g., OL: w.k.--soft, TL: w.k.--relaxed.

Three levels of Meaningful Similarity relations between responses, similar (S), neutral or unrelated (N), and opposed (O) were presented. Each OL and TL list consisted of 15 items, 5 Ss, 5 Ns, and 5 Os all counterbalanced and mixed at random; thus for the Meaningful Similarity variable, each subject was his own control. Each S learned, by the anticipation method, an OL to either a Low or High Practice criterion, and then a TL. There were 36 Ss in the Low Practice group and 36 in the High. All Ss were University of Hawaii students. Three dependent variables were scored on the TL trials: (1)(a) number of trials for each item to be obtained correct once, and (b) number of trials for each item to be obtained correct twice, (2) latency of correct responses, and (3) intrusions and blanks.

The statistical analyses performed on the data of the trials with the transfer list (TL) indicated no significant differences for any of the dependent variables with respect to Meaningful Similarity, i.e., significant differences between S, N, and O were not found with regard to trials-to-criterion, latency, or

intrusions. Significant differences, however, were found on the TL trials between the Low and High practice groups with respect to some of the intrusions and blank measures.

An analysis was made to determine whether those items coded for the S, N, and O relations had been differentially learned on the OL trials. The finding of a non significant Meaningful Similarity effect indicates that it is not likely that the findings of this study are biased as a result of initial inequities with respect to ease of learning on the original list.

Osgood has theorized that the more nearly similar are two responses, the less would be the interference in a Paradigm B transfer situation. He predicts an S N O order, where the S relation between responses (the most similar) results in the least amount of interference and the O relation (the least similar) results in the most amount of interference, i.e., S < N < O interference. The results obtained in the present investigation, S N O, differences not significant, do not support Osgood's theory.

378. Steinberg, D.D.C. The word sort: An instrument for semantic analysis. *Psychonomic Science*, 1967, 12, 541-542.

An objective instrument is developed which provides reliable psychological data with reference to semantic denotative features or components. The instrument, the Word Sort, is in the form of an individual word game in which Ss are instructed to arrange words into a number of groups according to some meaningful principle. Kinship terms were provided 21 Ss for dimensionalizing. Relatively high agreement among Ss was found with respect to the determination of semantic features.

379. Stimmel, D.T., & Stimmel, Nancy, S. Free recall as a function of intralist similarity and order of presentation constriants. *Psychological Reports*, 1967, 21, 541-544.

The free recall of low-meaningfulness CCC trigrams was studied as a function of fixed versus random order of presentation and high versus low intralist similarity. Order of presentation had no significant effect; however, the low intralist similarity group showed better free recall across 10 trials, with the superiority of the low intralist similarity group increasing across trials.

380. Stroud, J.B., & Maul, Ruth. The influence of age upon learning and retention of poetry and nonsense syllables. *Journal of Genetic Psychology*, 1933, 42, 242-250.

The purpose of this study is to determine the influence of age upon the memorization and retention of poetry and nonsense syllables in the case of 226 subjects. This is the first of two studies upon the general problem of the relation of age to acquisition and retention. In the present study, all age groups learned the same material. In a subsequent study, an attempt will be made to grade the material upon the basis of difficulty of comprehension, so that the material for any age group will be of the same relative difficulty as that used for any other age group.

In this study the following specific questions are studied: (1) The relation of CA to learning poetry and syllables; (2) the relation of MA to learning poetry and syllables; (3) the relation between IQ and poetry and syllable scores for the successive age groups; and (4) the relation of age to retention of poetry and syllables.

1. Within the limits of this study, learning scores for poetry and nonsense syllables increase with age.

2. The relation between chronological age and scores is largely spurious.

3. The relation between mental age and poetry and syllable scores is high and statistically significant.

4. This study reveals no relation between age and retention as measured by saving scores.

381. Tejirian, E. Syntactic and semantic structure in the recall of orders of approximation to English. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 1010-1015.

This study investigated the contribution of the syntactic, as opposed to semantic, component in the recall of orders of approximation to English. When recall was scored simply as number of words correctly recalled, it was found that differences in syntactic structure alone accounted for the observed increase in recall from the 1st order to the 2nd and 3rd. On the other hand, it was found that differences in semantic structure alone accounted for the observed increase beyond the 3rd order. It was further observed that, while semantic structure did not affect the total number of words recalled at the 2nd and 3rd orders, it did affect the length of correctly recalled sequences

at all orders beyond the 1st. Further analysis indicated that syntactic and semantic structure facilitated recall primarily by enabling Ss to group words into units or chunks of varying lengths, while the number of chunks recalled remains relatively constant.

382. Thompson, C.P., & Looney, Nancy, J. S-R similarity: Effect of location and predictability of repeated units. *Psychological Reports*, 1969, 24, 827-833.

Ease of learning a paired-associate list increases with the predictability of an intra-pair repeated unit. In addition, the pattern of errors, (e.g., percentage of omissions), made by S changes as the predictability of the repeated unit changes. Finally, the combination of S and R locations used to repeat the unit has an effect with the combination S_1-R_2 being less effective than the other combinations in aiding performance.

383. Thompson, C.P., Poling, D.R. Free recall of successive lists: Effects of category size and category repetition. *Psychonomic Science*, 1969, 16(4), 201-202.

Subjects classified and recalled four successive word list, each of which contained six obvious categories. Three categories were repeated in every list. Words from nonrepeated categories were recalled better than words from repeated categories and words from categories judged to be small were recalled better than words from categories judged to be large.

384. Tulving, E., & Patterson, R.D. Functional units and retrieval processes in free recall. *Journal of Experimental Psychology*, 1968, 77(2), 239-248.

The Ss recalled lists of 12, 16, 20, and 24 common words on a single trial. 4 types of lists were used. C lists consisted of unrelated words, while E, M, and D lists contained 4 highly related words in addition to unrelated words. The 4 highly related words appeared as a cluster at the end of E lists, in the middle of M lists, and were distributed throughout each list in D lists. Recall of words was highest for M lists, followed by E, D, and C, in this order. The number of recalled functional units, however, was identical for M and C, and lower in E than in M and C. The findings suggested that (a) highly related words are retrieved from secondary memory as a single functional unit, (b) unitization of related words in primary memory occurs only to a small extent, and (c) the number of retrieved functional units is independent of the size of the

units. Models of free recall postulating two types of memory store and transfer of information from one store to the other appear to be inconsistent with the data. A more appropriate view seems to be according to which primary and secondary memory represent different types of retrieval mechanism.

385. Turvey, M.T. Analysis of augmented recall in short-term memory following a shift in connotation. *British Journal of Psychology*, 1968, 59(2), 131-137.

The effect of connotative history upon a critical triad of connotatively defined words was studied in short-term memory. The critical triad was presented subsequent to a build-up in proactive interference. A release from proaction was obtained only when the history was one of homogeneous items connotatively different from the critical items; heterogeneous items connotatively different from the critical items did not produce the effect. This observation replicated in a second experiment was interpreted in terms of the operation of collative variables in the condition producing the release from proactive interference.

386. Turvey, M.T. Evidence of a connotative dimension in short-term memory as a function of retention interval. *Psychonomic Science*, 1967, 9(10), 547-548.

The possibility of a connotative dimension operating in STM was investigated by the use of an RIP design. Connotative difference between items did not facilitate recall at a retention interval of 12 sec but was found to be significantly effective at a retention interval of 24 sec. The results were discussed in terms of the notion that the manifestation of higher-order codes is time dependent.

387. Turvey, M.T., & Egan, J.F. Release from proactive interference in short-term memory as a function of change in visual and phonemic structure and retention interval. *Perception & Psychophysics*, 1970, 7(3), 169-172.

Experiment I demonstrated that in a short-term memory (STM) test series, a shift from a horizontal arrangement of the consonants comprising visually presented trigrams to a vertical arrangement, with phoneme class held constant, produced a highly significant release from proactive interference (PI). Release from PI was also observed with a shift from one phoneme class to another with spatial arrangement held constant. The effects of visual change and phoneme change were independent of each other. Experiment 2 verified the PI release effect of phoneme class

change but failed to confirm an observation in Experiment I that the effect of phoneme change was a function of the retention interval. The results were discussed in relation to interpretations of PI in STM and the interpretation of STM as a linguistic system.

388. Turvey, M.T., Fertig, J., & Kravetz, S. Connotative classification and proactive interference in short-term memory. *Psychonomic Science*, 1969, 16(4), 223-224.

Each of 360 Ss received four successive short-term memory test with connotatively defined word triads. All Ss in all conditions were presented on Test 4 with a word triad classified as evaluative negative on the semantic differential. The connotative classification of the triads on Tests 1-3 differed across conditions. A release from proactive interference was observed on Test 4 for both within-dimension and between-dimension shifts in connotation for both a 5-sec retention interval test series and a 20-sec retention interval test series. Proactive interference was not prevented, however, by changing the connotative classification of the triads on each of the successive short-term memory test. The results also suggested that a release from proactive interference be obtained with a change in polarity independent of connotative dimension changes.

389. Tversky, Barbara. Pictorial and verbal encoding in a short-term memory task. *Perception & Psychophysics*, 1969, 6(4), 225-233.

The present research attempted to manipulate the encoding modality, pictorial or verbal, of schematic faces with well-learned names by manipulating S's expectations of the way the material was to be used. On every trial, a single name or face was presented, followed by another one; the S was asked to respond "same" if the stimuli had the same name, and "different" otherwise. The majority of second stimuli of any session was either names or faces. It was hypothesized that if S had encoded the first stimulus in the modality of the second, his judgment would be faster than if he had not appropriately encoded the first stimulus. Significantly slower reaction times were obtained to stimulus pairs where the second stimulus modality was infrequent. Further evidence that encoding of the first stimulus was in the frequent second stimulus modality comes from the finding that "different" responses were shorter when the stimuli differed on more than one attribute in the encoding (second stimulus) modality, regardless of the modality of the stimuli. Thus, evidence is presented that not only can verbal material be pictorially encoded (and vice versa), but that whether either verbal or pictorial material is verbally or pictorially encoded depends on S's anticipation of what he is to do with the material.

390. Underwood, B.J. Studies of distributed practice: IX. Learning and retention of paired adjectives as a function of intralist similarity. *Journal of Experimental Psychology*, 1953, 45(3), 143-149.

The variables of the present experiments in learning of paired-adjective lists were: (a) intertrial interval (4, 30, and 60 sec.); (b) three degrees of stimulus similarity, and (c) three degrees of response similarity. Similarity was manipulated by varying the degree of synonymity among sets of words within a list. A separate experiment was performed for each level of similarity with intertrial rest varied within each experiment. Learning was always carried to one perfect trial with retention measured after 24 hr. The major results were as follows:

1. Intertrial interval was not related to either learning or retention.

2. Variation in response similarity did not influence rate of learning, but overt errors increased directly with similarity.

3. Variation in stimulus similarity had a complex effect on rate of learning, the medium-similarity lists taking longest to learn.

4. During learning, overt errors decreased directly with intertrial interval.

5. Neither response similarity nor stimulus similarity produced significant effects on retention.

No support was found for Gibson's theory which predicts that retention will decrease as a function of stimulus similarity. An evaluation of several previous experiments in relation to the present ones led to the proposal of two relationships which may account for discrepancies among experiments and clarify direction of subsequent research. These are: (a) when a item is reinforced a small number of times, it will be better retained if acquired by distributed practice than if acquired by massed practice; (b) if an item is reinforced many times, it will be better retained following massed than following distributed practice.

391. Underwood, J.B. False recognition produced by implicit verbal responses. *Journal of Experimental Psychology*, 1965, 70(1), 122-129.

200 words were read to 100 Ss at a 10-sec. rate. For each word S decided whether it had or had not been read earlier. Critical stimulus words were inserted in the list, these words being presumed to elicit specified implicit responses. Later in the list the assumed implicit response words were presented. For these latter words for 3 of 5 classes of words, false recognition was much higher than for control words. The greater the prior frequency of elicitation of the implicit response the greater the likelihood of false recognition.

392. Underwood, B.J. Attributes of memory. *Psychological Review*, 1969, 76(6), 559-573. (a)

A memory is conceptualized as a collection of attributes which serve to discriminate one memory from another and to act as retrieval mechanisms for a target memory. The attributes identified are temporal, spatial, frequency, modality, orthographic, associative nonverbal, and associative verbal. Some implications for the study of memory are discussed.

393. Underwood, B.J. Some correlates of item repetition in free-recall learning. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 83-94. (b)

The variables in six free-recall studies were the frequency of occurrence of a word within a single presentation of a long list of words, and the schedule of occurrences, either massed (MP) or distributed (DP). Recall of the DP words was much higher than that of the MP words. This was shown not to be due to rehearsal of other words during MP presentation. Degree of spacing of DP words had little influence on recall. The MP-DP difference also occurred in recognition memory. MP words presented with exactly the same frequency as DP words were judged to have occurred with far less frequency than the DP words, and it was concluded that the MP-DP difference was due to reception failure under MP which produced learning comparable to a lower actual frequency of presentation.

394. Underwood, B.J., & Ekstrand, B.R. Linguistic associations and retention. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 162-171.

Four experiments were concerned with the role of linguistic associations in producing interference in recall. In the first, strong associates were crossed (inappropriately paired) in a paired-associate list, and recall after 24 hr was compared with that for control lists. Although the crossed-associate list was more difficult to learn than the control lists, recall was superior. Evidence indicated the superiority was due to higher response availability. In Exp. II, connectives were used as stimuli in the critical list. Learning was slower than for the control lists but retention was not depressed. In Exp. III three interfering lists were used to study PI in the 24-hr recall of a fourth list. All lists had the same stimuli. For the E Group the pairs in the first three lists were associates; this was not true for the C Group. To equalize performance for the two groups on the first three lists the E Group was given one anticipation trial on each, the C Group five trials. Both groups had six trials on the fourth. Recall for the E Group was twice as high as that for the C Group and the magnitude of the recall (68%) indicated little PI. In Exp. IV the same lists were used but the E Group was given five trials on each of the first three lists. Recall for the E Group was 22%, and did not differ from the C Group. It was suggested that differentiation based on differences in trial frequency between the list to be recalled and the interfering lists was in part responsible for the high recall of the E Group in Exp. III.

395. Underwood, B.J., & Ekstrand, B.R. Studies of distributed practice: XXIII. Variations in response-term interference. *Journal of Experimental Psychology*, 1964, 68(2), 201-212.

6 experiments varied intertrial interval and interitem similarity in free learning or in paired-associate learning. Facilitation by DP was found only as an interlist effect, but this effect occurred only under certain situations. It occurred when paired-associate learning followed free learning of trigrams with low intralist similarity but not when the intralist similarity was high. In another situation it occurred when Ss were not naive, but did not occur when they were. No facilitation was found for DP in free learning. The particular locus (response-learning phase or associative phase) of the DP effect in paired-associate learning could not be identified. Other findings included: poorer performance in free learning for high-similarity units than for low, for both paced and unpaced recall; no effect of DP on 24-hr. retention; no difference in recall of paired-associate lists when the response terms were or were not shown on the recall trial.

396. Underwood, B.J., & Freund, J.S. Errors in recognition learning and retention. *Journal of Experimental Psychology*, 1968, 78(1), 55-63.

Ss were presented a list of 40 words (CR words) with instructions to remember the words but not the order. A recognition test for each consisted of a high associate (A word), one formally similar (F word), and one neutral (N word). All Ss pronounced the words on the learning trial and one group (F) was, in addition, required to pronounce an adjacent word which was either an A word, F word, N word, or number. Group F and 1 other group had an immediate recognition test. 2 other groups had recognition test 24 hr. following learning, 1 of these having had an immediate free-recall test. For Group F the nature of the errors was determined in large part by the nature of the adjacent item, but correct recognition did not differ as a function of the type of adjacent item. However, the confidence ratings of correctness indicated compensatory factors in the cases of A and F words. Without forced adjacent items on the learning trial, F words had no greater influence than N words, the A words providing the major source of error. Free recall enhanced 24-hr. recognition a small amount for the words recalled. 24% forgetting was observed over 24 hr. when measured by correct responses, 18% by confidence ratings of correct responses.

397. Underwood, B.J., & Freund, J.S. Further studies on conceptual similarity in free-recall learning. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 30-35.

Two experiments used a 40-word list presented for one study trial followed by free recall. The words consisted of eight instances each of five color concepts, the concepts being blocked in the list. Conceptual relatedness was minimal among the words unless appropriate color cues were provided. Both experiments showed that with appropriate cueing the recall was better the earlier the position of a word in the series of words representing the same concept. The slope of this recall curve was steeper than for control conditions (no cueing) and for consistently but inappropriately cued words. Cueing at recall had no influence. Instructions concerning the relevance of the color cue did not produce significant changes in recall. The data were inconsistent concerning the effect of appropriate cues on over-all recall.

398. Underwood, B.J., Ekstrand, B.R., & Keppel, G. An analysis of intralist similarity in verbal learning with experiments on conceptual similarity. *Journal of Verbal Learning and Verbal Behavior*, 1965, 4, 447-462.

An analysis was made of four subprocesses of verbal learning which may be expected to vary as intralist similarity (meaningful, formal, or conceptual) is manipulated in a PA list. Expectations were stated as to the role of each subprocess in over-all PA learning when similarity is manipulated among stimulus terms and among response terms independently. In the initial experiments, lists were constructed to eliminate two of the four subprocesses, leaving response learning and associative interference as the primary factors varying with conceptual similarity. The experiments showed that similarity among all stimulus terms was deleterious to learning while similarity among response terms had no effect on learning. These effects were independent of word frequency. Further experiments, devised to study response learning and associative learning independently, gave plausibility to the notion that with similarity obtaining among response terms, the positive effects of response learning balance the negative effects of associative interference for these materials. A final experiment varied the number of concepts within a list to examine the influence of a further hypothesized factor, S-R limitation. The overt-error data indicated the presence of this subprocess varying in extent as the number of concepts varied. However, the manner in which it contributed to over-all PA learning could not be ascertained.

399. Underwood, B.J., & Erlebacher, Adrienne H. Studies of coding in verbal learning. *Psychological Morographs*, 1965, 79(Whole No. 606), 1-25.

6 experiments are reported in which free learning (FL) and paired-associate learning (PAL) were examined with respect to the effects of coding of verbal units on learning. In 2 FL experiments and 1 PAL experiment where response terms were manipulated, encoding of trigrams to words produced a more meaningful unit. Such encoding was shown to influence learning positively only if decoding was simple. Encoding of a stimulus term to a word was also shown to influence learning positively, but such encoding did not occur unless the possibilities were easily perceived. Finally, an experiment demonstrated sound coding of response terms, but the positive effect on transfer was small and limited to unmixed lists. We concluded that coding systems: (a) may influence learning positively if decoding is simple: (b) will produce only a small positive effect even under favorable conditions; (c) may have no positive effect even if used and may, under certain conditions, inhibit learning.

400. Underwood, B.J., Runquist, W.N., & Schulz, R.W. Response learning in paired-associate lists as a function of intralist similarity. *Journal of Experimental Psychology*, 1959, 58(1), 70-78.

Verbal learning may be conceptualized as a two-stage process. In the first phase S must learn the responses, in the second he must attach them to specific stimuli. The present experiments dealt directly with the first stage only. It was hypothesized that: (a) response learning is initially more rapid the higher the response similarity in a paired-associate list; and (b) teaching S the responses before he learns a paired-associate list would initially facilitate the learning of this list.

Two paired-associate lists were used. The stimuli for both lists were nonsense syllables, the responses, adjectives. In one list the adjectives were all similar in meaning, in the other, dissimilar. In one set of conditions (control), Ss merely learned the paired-associate lists by standard procedures for 15 trials. In a second set of conditions, Ss were taught the responses prior to learning the paired-associate list for 15 trials. In the third set of conditions standard paired-associate learning was used but different groups of Ss were stopped after 1, 2, 3, 5, 8, and 13 trials and were asked to write down all the responses they could remember. These three sets of conditions required 16 groups of Ss. There were 20 in each group, all naive to verbal learning experiments.

The results show that:

a) Teaching S the responses prior to paired-associate learning facilitates the learning of lists with both high and low similarity among the responses. A second experiment showed that this effect cannot be ascribed to warm-up or learning-to-learn resulting from the procedure of teaching S the responses before paired-associate learning. In both experiments the positive effect was evident throughout the entire 15 trials for lists of high response similarity. For low similarity the effect was only in initial learning for one comparison but present throughout learning in the other.

b) In response learning (prior to paired-associate learning) items with high similarity are learned initially more rapidly than are items of low similarity, although for both lists learning was very rapid. When Ss are tested for free recall at various points in learning a paired-associate list, more responses are given from a high-similarity list than from a low-similarity list even though over-all

level of paired-associate learning is higher for the low-similarity list. The difference in this response recall was clearly evident for the first few trials.

The results confirm the expectation that high intralist response similarity would facilitate response learning. Thus, the results are consistent with the two-stage conception of learning. Furthermore, the present results aid in understanding certain previous findings on the roles of stimulus similarity and response similarity in verbal learning.

401. Voss, J.F. Intralist interference in associative learning. *Journal of Verbal Learning and Verbal Behavior*, 1967, 6, 773-779.

A 2 x 5 factorial design was used in which six high-m or six low-m pairs were presented for 1, 2, 4, 8, or 16 trials. Following the presentations, Ss were required to recall the individual items of the list, recall the pairs of the list, and rate each item with respect to its degree of association with every other item in the list. The recall results indicated significant effects of trials and m value and also showed that of the total items recalled, the low-m condition had a relatively larger number of items recalled individually rather than recalled as pairs, whereas the high-m condition had a larger number of items recalled as pairs. The rating results for both m conditions revealed that items correctly learned as pairs tended to be rated as associated to each other and as not associated to other items. In addition, for high-m pairs, items correctly recalled but not learned as one item of a pair tended to be rated as more associated to other items of the list than items not recalled. The findings were discussed in terms of their relation to associative learning.

402. Wallace, W.P. Consistency of emission order in free recall. *Journal of Verbal Learning and Verbal Behavior*, 1970, 9, 58-68.

Phenomena of clustering and subjective organization in free recall were incorporated within an associative explanatory framework. Both are defined by consistency of recall orders. Recall-order consistency was assumed to reflect the organization S imposes upon material he is required to memorize. Contiguity of experience ("thinking" about items together during the experiment) was proposed as the dominant force underlying the consistency in recall order. According to the contiguity principle, items experienced together will be recalled together. The major determinants of specific contiguity relations identified were the arrangement of items during study trials by E, the arrangement of items during test trials by S, and modifications or prior input and output orders which result from rehearsal and mediating activities on the part of S.

403. Wallace, W.P. Implicit associative response occurrence in learning with retarded subjects: A supplementary report. *Journal of Educational Psychology*, 1967, 58(2), 110-114.

100 words were read to groups of normal and retarded Ss. As each word was read Ss were required to indicate whether it had been read earlier in the list. Words appeared in the list which were presumed to elicit specific implicit associative responses (IARs), and later in the list the presumed IARs were presented. A significant interaction indicated that this manipulation resulted in a greater increase in error rates for normal Ss than for retarded Ss. The results were interpreted as supporting the notion that retarded Ss make fewer or weaker IARs when presented with verbal units.

404. Wallace, W.P. Incidental learning: The influence of associative similarity and formal similarity in producing false recognition. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 50-54.

The present study was designed to test whether the occurrence of implicit associative responses (IARs) is primed by instructions to learn. There were two kinds of experimental (E) words in a 200-word list: E words presumed to have been elicited as IARs by earlier list words, and E words formally similar (FS) to earlier list words, but presumed not to have been elicited as IARs. The number of times Ss reported that E words had been presented earlier (false positives) was compared with the number of false positives to control words.

The results indicated that absence of instructions to learn did not reduce IAR occurrence below the level to which it was reduced by engaging in the orienting task. That is, Ss performing the orienting task did not show increased error rates for E words presumed to have been elicited earlier as IARs. Performing the orienting task was responsible for interference for the FS class. It was suggested that this latter finding occurred because Ss performing the orienting task responded to the words in the same way it is assumed Ss respond to nonsense material.

405. Wallace, W.P., & Calderone, R.N. Implicit responses in incidental learning. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 136-142.

Three experiments were conducted to investigate the role of implicit associative response (IAR) occurrence in incidental learning. Lists of conceptually related words were presented at a rapid rate followed by a test of free recall. Although differences among groups were small, recall scores and clustering

scores consistently favored the intentional learners. It was suggested that the procedures which define incidental learning result in a reduction in IAR occurrence.

406. Wallace, W.P., & Underwood, B.J. Implicit responses and the role of intralist similarity in verbal learning by normal and retarded subjects. *Journal of Educational Psychology*, 1964, 55(6), 362-370.

This study was based on the assumption that implicit associative responses (IARs) to verbal stimuli are less likely to occur in retarded than in normal Ss. With normal Ss IARs to conceptually related words should facilitate free learning and retard PA learning. For retardates, if IARs do not occur or occur weakly, conceptual similarity should have little effect on either type of learning. The expected triple interaction between class of S, type of task, and similarity was found. Retardates showed fewer within-concept errors in PA learning and less clustering in free learning than did normals.

407. Warren, R.M. Verbal transformation effect and auditory perceptual mechanisms. *Psychological Bulletin*, 1968, 70(4), 261-270

Continued listening to recorded repetitions of a single word or phrase induces illusory changes. These "verbal transformation" (VT's) may range from a word that rhymes with the actual stimulus to extreme phonetic distortions. The VT effect has revealed semantic and phonetic aspects of verbal organizational processes. It is suggested that the strategies employed for the perception of connected discourse change in a regular manner throughout the normal life span. Some aspects of VT's appear related to other perceptual phenomena including aphasia and both auditory and visual illusions induced by unchanging patterns of sensory input.

408. Waugh, Nancy, C., & Norman, D.A. Primary memory. *Psychological Review*, 1965, 72(2), 89-104.

A model for short-term memory is described and evaluated. A variety of experimental data are shown to be consistent with the following statements. (a) Unrehearsed verbal stimuli tend to be quickly forgotten because they are interfered with by later items in a series and not because their traces decay in time. (b) Rehearsal may transfer an item from a very limited primary memory store to a larger and more stable secondary store. (c) A recently perceived item may be retained in both stores at the same time. The properties of these 2 independent memory systems can be separated by experimental and analytical methods.

409. Weber, Rose-Marie. A linguistic analysis of first-grade reading errors. *Reading Research Quarterly*, 1970, 6, 427-451.

ANALYZES ORAL READING errors observed in a first-grade classroom as approximations to the correct response in terms of letters, word structure, grammatical acceptability, and semantic appropriateness. A measure of graphic similarity showed that better readers excelled weaker readers in more closely approaching the correct response; both groups improved throughout the year. On the syntactic level, judgments of grammatical acceptability reinforced by part-of-speech analysis showed that the class made responses that in general conformed to the constriants of preceding grammatical context, indicating that both strong and weak readers brought their knowledge of linguistic structure to bear on the identification of words. Some evidence arose for an inverse relationship in the use of graphic information and grammatical context. Judgments of semantic appropriateness in the sentence indicated that a response that was syntactically acceptable was almost always semantically appropriate as well.

410. Weber, Rose-Marie. The study of oral reading errors: A survey of the literature. *Reading Research Quarterly*, 1968, 4, 96-119.

REVIEWS HOW oral reading errors have been analyzed in more than thirty studies to establish norms for the diagnosis of reading difficulties and to provide insight into the nature of the reading process. The assumption that oral reading reflects the silent reading process is discussed and various systems for describing errors, studies indicating the strategies that readers use to exploit graphic and contextual information, related variables such as maturity, differential training, difficulty of materials, and response style are considered. Notable in much of the research in this area is the failure of investigators to take into account the various levels of linguistic structure or to indicate how closely an erroneous response approximates an expected response on any of those levels.

411. Weingartner, H. The free recall of sets of associatively related words. *Journal of Verbal Learning and Verbal Behavior*, 1964, 3, 6-10.

Two sets of 15 associatively related words were presented to 168 Ss for free recall. Ss recalled a greater number of words when they were presented in constrained rather than random arrangements. Cueing did not influence the number of words correctly recalled but did change the associative structure present at the time of free recall and thereby altered

which of the words were recalled. Associative structure was found to predict the frequency with which individual words were recalled and the occurrence of intrusions.

412. Weinsberg, R.W. Sentence processing assessed through intrasentence word associations. *Journal of Experimental Psychology*, 1969, 82(2), 332-338.

Two experiments were conducted to study sentence structure through intrasentence word association. The Ss learned a sentence and were then given individual words from the sentence as stimuli for word association, with the other words in the sentence as possible responses. Generally, the most frequent response to each word in a sentence was a word closely related to the stimulus word in the deep structure of the sentence rather than a word in close physical proximity to the stimulus. In Exp. I, a string of English words, when given two different structures through the use of appropriate context, gave two different patterns of word associations, and these patterns corresponded to the differences in underlying structure. In Exp. II, sentences with very different surface structures but the same underlying structure gave very similar patterns of intrasentence word associations. The results from the two experiments indicated that the deep structure of sentences was the most important factor in determining the organization that a speaker gives to a sentence.

413. Whimbey, A.E., & Fischhof, Valerie. PI in STM resulting from the semantic similarity of items. *Psychonomic Science*, 1968, 13(2), 127.

Two experiments were performed to test the hypothesis that semantic similarity does not give rise to interference in STM. In both experiments a Peterson and Peterson type of STM task was used in which the Ss were required to recall three words after some intervening activity. All Ss were required to recall three sets of words. The last set was the critical test series and was identical for the experimental and the control groups. However, for the experimental group the first two series were semantically similar to the test series, whereas the control group had semantically dissimilar itesm. In both experiments the control group showed better recall than the experimental group, indicating that semantic similarity does in fact give rise to PI in STM.

414. Wickelgren, W.A. Acoustic similarity and intrusion errors in short-term memory. *Journal of Experimental Psychology*, 1965, 70(1), 102-108. (a)

36 undergraduates were given lists of 8 items (4 digits and 4 letters) presented at .75 sec/item with ordered recall instructions. Ss were either to copy the items as presented and then recall or to recall the items without prior copying. Recall after copying was slightly worse than recall without copying ($p < .05$). In both conditions, intrusions among letters and between letters and numbers tended to follow acoustic similarity ($p < .001$). Vowel similarities were more important than consonant similarites, but both effects were significant ($p < .001$). There was a correlation of .58 between the number of letters similar to a presented letter and the frequency with which that letter was forgotten ($p < .01$). Short-term memory appears to use an auditory or speechmotor code.

415. Wickelgren, W.A. Acoustic similarity and retroactive interference in short-term memory. *Journal of Verbal Learning and Verbal Behavior*, 1965, 4, 53-61. (b)

Short-term memory for a list of four letters, followed by a list of eight letters that the Ss copied as they were presented, followed by immediate recall of the original four-letter list, was shown to be a function of the acoustic similarity of the intervening list to the original list. An interfering list whose letters have similar pronunciation to the letters in the original list produces greater RI than an interfering list whose letters have a very different pronunciation from the letters in the original list. An interfering list composed of items identical to items in the original list, but in a different order, tends to produce less RI in the recall of items and more RI in the recall of the correct position of these items than an interfering list composed of similar items. These findings for STM are completely consistent with analogous studies of RI as a function of similarity in LTM.

416. Wickelgren, W.A. Short-term memory for phonemically similar lists. *American Journal of Psychology*, 1965, 78, 567-574. (c)

In the first experiment 31 Ss attempted ordered recall of two types of 9 letter lists: phonemically similar lists in which all letters had a common vowel phoneme ($\bar{a}$, $\bar{e}$, or $\breve{e}$) and phonemically different lists whose letters had no common phoneme. Ordered recall was poorer for similar lists ($p < 0.001$), but this resulted entirely from poorer recall of the position of similar letters ($p < 0.001$). Item-recall, by a free recall criterion was not significantly different for the two types

of lists. In the second experiment 28 Ss attempted ordered recall of the consonants only, from two types of lists of seven consonant-vowel diagrams: phonemically similar list in which the vowel was identical for all seven diagrams (ā, ē, ī, ō, o͞o) and phonemically different lists whose seven vowels were a mixture of the above five vowels. Position-recall was significantly poorer for phonemically similar list ($p < 0.001$), but item-recall was significantly better for similar lists ($p < 0.001$).

417. Wickelgren, W.A. Associative intrusions in short-term recall. *Journal of Experimental Psychology*, 1966, 72(6), 853-858. (a)

30 MIT undergraduates listened to a list of 9 letters presented at the rate of 4 letters per second and then attempted to recall the letters in order. Some lists contained repeated letters, and some did not. The letters following repeated letters tended to be substituted for each other in recall, by comparison to the frequency of confusing letters in the same positions of lists without repeated letters. Such substitutions were called "associative intrusions," and the associative-intrusion phenomenon was observed whether the repeated letters occurred at the beginning or the middle of the list, whether 1 or 2 items separated the repeated letters, and whether the items following the repeated items did or did not have a vowel phoneme in common. The results were interpreted as supporting an associative theory of short-term memory.

418. Wickelgren, W.A. Distinctive features and errors in short-term memory for English consonants. *Journal of the Acoustic Society of America*, 1966, 39(2), 388-398. (b)

Errors in short-term recall of 23 English consonants were tabulated and related to three distinctive-feature systems. The consonants were always presented in initial position in a consonant-vowel diagram, and the vowel was always /a/. Subjects were instructed to copy a list of consonants as it was being presented, followed by recall of the list. Perceptual errors were excluded from the recall-errors matrix by scoring for recall only correctly copied consonants. The data were also analyzed in such a way as to eliminate differences in response bias for different consonants. Having controlled for response bias, each feature system makes predictions about the rank order of different intrusion errors in recall. Each of the three feature systems was significantly more accurate than chance in these predictions, but the most accurate system was one developed in the present study. This system is a slightly modified version of the conventional phonetic analysis of consonants in terms of voicing, naslity, openness of the

vocal tract (manner of articulation), and place of articulation. The results suggest that a consonant is coded in short-term memory, not as a unit, but as a set of distinctive features, each of which may be forgotten as least semiindependently.

419. Wickelgren, W.A. Phonemic similarity and interference in short-term memory for single letters. *Journal of Experimental Psychology*, 1966, 71(3), 396-404. (c)

172 Ss copied a list of PI letters, then copied a single letter to be recalled later, then copied a list of RI letters, and then attempted recall of the single letter. The length (0, 4, 8, or 16 letters) and phonemic similarity (0, 25, 50, 75, or 100% similar letters) of the PI and RI lists were varied systematically. Both PI and RI were demonstrated in STM for single letters ($p < .001$). RI continued to increase with increasing length of RI list; PI did not increase appreciably beyond 4 letters. Both PI and RI increasing phonemic similarity of the PI and RI lists for low and medium degrees of similarity of the other interference list, RI or PI list, respectively ($p < .001$). The findings suggest a 2-factor theory of forgetting in STM, involving retrieval interference and decay or storage interference.

420. Wickelgren, W.A. Short-term recognition memory for single letters and phonemic similarity of retroactive interference. *Quarterly Journal of Experimental Psychology*, 1966, 18, 55-62. (d)

Copying 12 letters produces more retroactive interference in recognition memory for a single letter when the interference letters possess a vowel sound in common with the letter to be remembered than when they do not. Compared to interference list that do not include the present letter, inclusion in the interference list of the letter to be remembered improves recognition memory when the other interference letters have no vowel sound in common with the letter to be remembered, but not otherwise. False recognition rates are greater when the test letter contains a vowel sound in common with the present letter than when the vowel sounds of these two letters are different. The findings are in complete accord with analogous findings for short-term recall and indicate that short-term recognition memory uses the same phonemic-associative memory system as short-term recall.

421. Wickelgren, W.A. Auditory or articulatory coding in verbal short-term memory. *Psychological Review*, 1969, 76(2), 232-235. (a)

Attempts to determine whether the verbal short-term memory (STM) trace is in an auditory system or an articulatory system by comparison of the confusion matrices for auditory recognition and STM are shown to be based on assumptions that are very likely invalid. Attempts to decide this question by means of the effects of noise on STM are also shown to be inconclusive. Finally, the possibility must not be ignored that the trace is in an abstract verbal system that is neither purely auditory not purely articulatory.

422. Wickelgren, W.A. Context-sensitive coding, associative memory, and serial order in (speech) behavior. *Psychological Review*, 1969, 76(1), 1-15. (b)

The problem of serial order in noncreative behavior is defined in much the same manner as Lashley (1951), and several theories of serial order are examined. Lashley's rejection of associative-chain theories of serial order is shown to apply to one particular theory, and to be invalid as applied to other associative theories. Indeed, the most plausible theory is the "context-sensitive associative theory," which assumes that serial order is encoded by means of associations between context-sensitive elementary motor responses. In speech, this means that a word such as "stop" is assumed to be coded "allophonically" as /$_{\#}s_{t}$, $s^{t}{}_{o}$, $t^{o}{}_{p}$, $o^{p}{}_{\#}$/, rather than being coded phonemically as /s, t, o, p/. This theory handles the pronunciation of single words and even phrases in a certain sense.

423. Wickelgren, W.A., & Norman, D.A. Strength models and serial position in short-term recognition memory. *Journal of Mathematical Psychology*, 1966, 3, 316-347.

A number of continuous strength models for memory are developed for tested by an experimental study of recognition memory for three-digit numbers at all serial positions in lists of length two through seven. Empirical estimates of trace strength in different conditions, independent of response bias, are obtained by means of the operating characteristic. The principal theorical findings are: (a) strength in short-term memory (STM) appears to decay exponentially with the number of subsequent items; (b) subjects report that they recognize an item if and only if strength in memory exceeds a criterion; (c) the first item of a list is remembered better than subsequent items because it receives a greater increment in strength in STM upon presentation, not because it decays more slowly in STM or because it acquires some strength in a long-term memory.

424. Wickens, D.D. Encoding categories of words: An empirical approach to meaning. *Psychological Review*, 1970, 77(1), 1-14.

This article reports a series of studies investigating the dimension along which words are encoded, using the "release from proactive inhibition" in short-term memory technique. The results of the experiments indicate that different dimensions vary in their effectiveness for proactive inhibition release. In general, semantic dimensions (taxonomic categories or semantic differential) are highly effective, whereas physical characteristics such as word length or figure-ground colors of the slide presentation are relatively ineffective in releasing proactive inhibition. The results of this technique of measuring encoding are related to other types of experiments on verbal well as to the topic of subception and imageless thought.

425. Wickens, D.D., Born, D.G., & Allen, C.K. Proactive inhibition and item similarity in short-term memory. *Journal of Verbal Learning and Verbal Behavior*, 1963, 2, 440-445.

The experiment investigated the effect of proactive inhibition in short-term retention as a function of degree of similarity between the proactive items and the critical test items. When the same class of material, CCC's or NNN's, was used for proactive and test items, marked interference was obtained with as few as three proactive items. No evidence for proactive inhibition was found when the proactive and test items were drawn from different classes of materials, CCC to NNN, or vice versa. There was no evidence that formal similarity (same units in proactive items as in test items) produced greater interference than that obtained from proactive items lacking this formal similarity, but the failure to find any difference may have arisen from the large amount of interference already present.

426. Wickens, D.D., & Clark, Sandra. Osgood dimensions as an encoding class in short-term memory. *Journal of Experimental Psychology*, 1968, 78(4), 580-584.

3 experiments were conducted to determine whether or not words are encoded for short-term memory (STM) storage by the connotative meaning of the extremes of the 3 dimensions of the Osgood semantic differential. 50 experimentals and 50 controls served in each experiment. After reciting 3 words (a triad) twice and a backwards counting task, Ss attempted recall. On the 5th trial experimental groups were presented a triad from the opposite end of the same differential scale; control groups received a triad from their usual end of the dimension. In all instances the experimental groups excelled the control

groups to a significant degree on the shift trial, or, in other words, a release of proactive inhibition (PI) occurred. The results imply that the words at each end of the semantic differential scale are homogeneously encoded in STM and represent a psychological class differing from words at the other end of the scale.

427. Wickens, D.D., & Eckler, G.R. Semantic as opposed to acoustic encoding in STM. *Psychonomic Science*, 1968, 12(2), 63.

The Ss were given triads of consonants or words in the Peterson and Peterson situation. After PI had been built up for the CCCs the Experimental group was given a word trigram such as Pea, Kay, Bee, and the Control group received the homophonic triad P, K, B. A significant improvement in performance was shown for the Experimental group and none for the Control. It is concluded that semantic factors override any acoustic factors which might operate in this type of STM situation.

428. Wicklund, D.A., Palermo, D.S., & Jenkins, J.J. Associative clustering in the recall of children as a function of verbal association strength. *Journal of Experimental Child Psychology*, 1965, 2, 58-66.

Two experiments were designed to demonstrate the influence of free association strength on the recall of fourth grade Ss. The list for Exp. I included 15 highly associated word-pairs, randomly presented along with 6 filler words. Sixty Ss recalled significantly more associative clusters than randomly selected clusters. Clustering was apparent in both S-R and R-S directions and the amount of clustering paralleled the mean forward and reverse associative strengths based upon fourth grade word association norms. In Exp. II the 30 test words were composed of 5 high, 5 medium, and 5 low-strength associative pairs. For 61 Ss, all measures of clustering were directly related to the average degrees of associative strength for the three sets of pairs.

429. Willner, A.E., & Reitz, W.E. Association strength as a mediating variable in verbal categorizing and recall: Preliminary report. *Psychological Reports*, 1965, 16, 310.

Method--ten lists, the high-associated and zero-associated lists for five of Deese's stimulus words, were used. The low-association lists and the lists for one word (music) were omitted because of limited time avaliable with the 25 college student Ss. The 10 lists were assembled into a booklet in ABBA order

and Ss were asked to sort the words in each list into as many or few groups as they wished and to give the reason for each group.

Results--fewer groups were sorted for high-associated than for zero-associated lists ($p < .001$). The results for all 25 Ss, moreover, were in the predicted direction. The number of groups formed for each of the 10 lists correlated (rho = -.74, $p < .02$) with IIAS, and (rho = -.85, $p < .01$) with the number of words recalled. (The IIAS measures and mean number of words recalled for each list were obtained form Deese's data.) Results indicate that the degree of associative connections between words is related to both the recall of the words and also to conceptual tasks, e.g., a word-sorting task. Further studies investigating the conceptual organization of recall as well as the relationship between association and abstraction are being pursued.

430. Wimer, Cynthia. An analysis of semantic stimulus factors in paired-associate learning. *Journal of Verbal Learning and Verbal Behavior*, 1963, 1, 397-407.

Previous research has found the major stimulus characteristics related to difficulty of paired-associate learning to be meaningfulness, familiarity, and intralist similarity. In general, meaningfulness and familiarity have been shown to be inversely related to difficulty, while similarity is directly related.

The present study employed a correlational design in order to examine the relationships between meaningfulness, familarity, similarity, and several other semantic characteristics of stimuli, as well as their relation to difficulty. Thirty-two lists, consisting of six words each, were constructed from a basic pool of 32 common nouns. Measures of the difficulty, meaningfulness, and similarity of the lists were obtained experimentally, and published semantic-differential ratings were used to scale the lists on the remaining variables.

The correlational analysis showed difficulty to be related to intralist stimulus similarity, but not to stimulus meaningfulness or familarity. A factor analysis of the correlation matrix showed that both connotative and associative similarity are major factors in simple judged similarity, but that only associative similarity affects difficulty. Meaningfulness, to the extent that it is defined as intensity of meaning, had a negative relationship with difficulty. Familarity, however, was not correlated with either difficulty or meaningfulness. Meaningfulness and similarity were found to be positively related

431. Wimer, R. Osgood's transfer surface: Extension and test. *Journal of Verbal Learning and Verbal Behavior*, 1964, 3, 274-279.

The purpose of the experiment was to determine transfer effects for (a) Osgood's Surface as presently defined, and (b) additional points on the enlarged Surface resulting from extension of interlist stimulus similarity from identical, similar, and unrelated to include opposed and antonymous.

Subjects learned a final common list after learning one of twenty-five different first lists having one of five categories of interlist simulus similarity (identical, similar, unrelated, opposed, or antonymous) combined factorially with one of the same five conditons of interlist response similarity.

Results suggested (acceptable levels of statistical significance were hardly ever achieved) were (a) when stimuli on both lists are identical or similar, positive transfer occurs for opposed and antonymous response relations as well as for those of identity and similarity; (b) when responses are identical on both lists, only high degrees of stimulus similarity produce positive transfer; (c) when stimuli are meaningfully opposed or antonymous, positive transfer occurs only when responses are also meaningfully opposed or antonymous; and (d) simultaneous variation of interlist stimulus and response similarity tends to produce increasing positive transfer as relation between lists, either similarity or opposition, increases.

432. Winitz, H., & Bellerose, Betty. Phoneme--sound generalization as a function of phoneme similarity and verbal unit of test and training stimuli. *Journal of Speech and Hearing Research*, 1963, 6, 379-392.

Phoneme generalization as a function of phoneme similarity and the verbal unit in which the phonemes appeared was investigated. Subjects were children from the first and second grades. For all ten pretaining trials correct responses were reinforced. The test trial was presented on the eleventh trial. For all conditions the test and training stimuli were presented as part of a syllable and in some cases the syllables were words. Test and training stimuli were formed by altering the initial consonant of the syllables. For all conditions the training stimuli were either /c/ or /ʃ/ and the test stimuli were one of the following: /tʃ/, /s/, /θ/, and /t/.

The results indicated that stimulus generalization occurred with the test stimuli /tʃ/ and /s/. The verbal unit of the test and training stimuli was found to influence generalization, although the findings were not consistent for the experimental sounds employed in the present study. It was also found that stimulus generalization can, for the most part, be maintained with reinforcement.

433. Winograd, Eugene. List differentiation, recall, and category similarity. *Journal of Experimental Psychology*, 1968, 78(3), 510-515.

Following the presentation of 2 lists of words, Ss were asked to identify the list membership of all words seen on both lists. List 1 and List 2 were related in that each consisted of 6 instances of each of 6 categories, or 36 words, and 3 of the categories were common to both lists. List differentiation was significantly poorer by sign test for words from repeated (R) categories than from nonrepeated (NR) categories. In Exp. II, recall for both lists was tested following the same presentations of the list as in Exp. I. While total words recalled did not differ for R and NR categories, category recall was significantly poorer for List 1 NR over R categories, and words recalled per category recalled was significantly poorer for List 1 R over NR categories. The results were discussed both in terms of a recency principle operating in conjunction with an overload memory and in terms of an unlearning mechanism.

434. Wood, G. Category names as cues for the recall of category instances. *Psychonomic Science*, 1967, 9(6), 323-324.

Two experiments were conducted to extend the Tulving and Pearlstone (1966) finding that providing Ss with category names facilitates their recall of category instances. Experiment 1 demonstrated that this facilitation does not depend on the presence of the category names during the learning trial. Experiment 2 showed that the effectiveness of the category name as a cue for recall depends on the strength of the pre-established connection between the category name and the instance of the category to be recalled.

435. Wood, G. Free recall of nouns presented in sentences. *Psychonomic Science*, 1970, 18(2), 76-77.

The results of two experiments indicated that the presence of sentences as context has a deleterious effect on the recall and clustering of related nouns, even when the method of complete presentation is used and the nouns are underlined. There was weak evidence that the sentence-context effect was due to the presence of context words and not to the ordering of the context words as sentences.

436. Wood, G., & Underwood, B.J. Implicit responses and conceptual similarity. *Journal of Verbal Learning and Verbal Behavior*, 1967, 6, 1-10.

This study offers an explanation for the superior free recall of conceptually related words. In this explanation the common implicit associational response (IAR) is assumed to produce increased frequency of the appropriate representational response (RR) via the backward association. The theory leads to the prediction that in a series of conceptually related words those presented first in the series will be better recalled than those presented later. Although the amount of facilitation and the number of "early" words facilitated depended somewhat on the number of conceptually related words presented, the results gave some support to the prediction. Furthermore, a second study demonstrated that the facilitation of the earlier words resulted from events taking place during presentation, i.e., during learning, and not during recall.

437. Wright, J.H. Effects of formal interitem similarity and length of retention interval on proactive inhibition of short-term memory. *Journal of Experimental Psychology*, 1967, 75(3), 386-395.

20 Ss were randomly assigned to each of the 12 experimental conditions defined by the individual testing for STM of 6 CCC trigrams sharing 0, 1, 2, or 3 consonants under a 3-sec., 9-sec., or 18-sec. retention interval. Increasing the length of retention interval reduced the likelihood of recalling the consonants of a trigram and also increased STM recall latency. Increasing the similarity of prior test items reduced the likelihood of recalling the consonants of a trigram in their correct trigram-letter positions. Prior-item intrusions at STM recall were increasing function of interitem similarity but were unrelated to the length of retention interval. These findings suggested that interitem similarity was detrimental to the storage of a later item for STM through a process of interitem associative interference and that the increasing length of retention interval provided increasing time for forgetting via memory-trace decay.

438. Yavuz, H.S., & Bousfield, W.A. Recall of connotative meaning. *Psychological Reports*, 1959, 5, 319-320.

A group of Ss learned to respond to Turkish words with familiar words purporting to be their English equivalents. Retention was tested one week later by presenting each Turkish word for translation. Whether the translation could or could not be recalled, Ss rated the Turkish words on the GOOD-BAD scale of the semantic differential. Ss showed a significant tendency

to retain the connotative meanings assumed to have been acquired by the Turkish words in the initial learning even when they were unable to recall their supposed translations.

439. Young, R.K., & Underwood, B.J. Transfer in verbal materials with dissimilar stimuli and response similarity varied. *Journal of Experimental Psychology*, 1954, 47(3), 153-159.

The A-B, C-B paradigm in verbal learning is commonly said to be the basic paradigm for positive transfer. Furthermore, it is commonly believed that as the responses in the paradigm become less and less similar, positive transfer decreases. Such a relationship cannot be predicted strictly on the basis of interlist stimulus or response generalization. However, such a relationship would be expected if there is a transfer of response differentiation from the first to the second task.

The present experiments studied positive transfer in paired-associate lists when interlist response similarity was varied from identity to low similarity, with the interlist stimulus similarity always low. Lists were constructed so that intralist response similarity was low. Under such conditions generalization theory would predict no relationship between response similarity and transfer. However, since it is difficult to remove all similarities amoung responses, two parallel experiments were performed in which one provided for predifferentiation of responses before learning the first paired-associate list and the other did not. If transfer of response differentiation is effective even when responses have low intralist similarity, the predifferentiation produce would eliminate it from transfer measurements.

Predifferentiation of responses was carried out by verbal-discrimination learning prior to the learning of the two paired-associate lists for a given condition of response similarity. Learning of all lists was carried to one perfect trial.

The results show: (a) Interlist response similarity was not related significantly to amount of transfer in either experiment. (b) The predifferentiation procedure had a small but satistically insignificant effect on transfer. (c) Significant positive transfer occurred in all conditions.

These results indicate that A-B, C-B cannot be considered a basic paradigm of positive transfer any more than can a paradigm in which responses are quite dissimilar. Whether or not interlist response similarity is related to amount of positive transfer (when stimuli are dissimilar) probably depends upon the level of intratask response similarity.

440. Youniss, J., Feil, R.N., & Furth, H.G. Discrimination of verbal material as a function of intrapair similarity in deaf and hearing subjects. *Journal of Educational Psychology*, 1965, . 56(4), 184-190.

Discrimination difficulty of visually presented word pairs as a function of intrapair meaningful, formal, and expressive similarity was studied in Exp. I with deaf and hearing adolescents (30 in each group) and in Exp. II with deaf and hearing college students (20 in each group). Data of Exp. I indicated that both adolescent groups discriminated pairs of high formally similar words with greater difficulty than pairs low in formal similarity, and that neither group was affected by expressive similarity provided by homosigns or homonyms. Additionally, hearing adolescents discriminated pairs which were high in meaningful similarity with more difficulty than pairs low in meaningful similarity; deaf adolescents were relatively unaffected by the meaningful variable. Over all conditions deaf subjects showed superior discrimination. Results of Exp. II were consistent with those in Exp. I with 1 exception; deaf college students found discrimination of high meaningful similarity pairs relatively more difficult than low. The findings suggested that covert designation of the stimuli probably was not part of the discrimination process, and that linguistic competence was relatively unrelated to performance in this type of verbal learning situation.

441. Zavortink, Bonnie, L. Retroactive inhibition in free-recall learning of conceptually related words as a function of change of context and interlist similarity. *Dissertation Abstracts*, 1968, 3523-B.

Free-recall learning (FRL) has been hypothesized to involve two components: contextual associations between the experimental context and the items to be learned and interitem associations among the items to be learned. The present experiment investigated the occurrence of retroactive inhibition (RI) for each of these components by varying the overlap of stimulus cues for the components separately. In the manipulation of the similarity of contextual cues, successive lists were learned either in an unchanged physical environment, or in a changed environment. In addition, some subjects (Ss) learned the list in an unchanged physical environment, but were matched with the changed group in physical activity between the successive lists. The manipulation of similarity of interitem associations was effected by use of the same or different conceptual categories in the two lists. Low probability categories based on sensory concepts were used, with Ss either instructed to use the categories, or uninstructed about the categorical nature of the lists. It was

hypothesized that only the groups instructed about cue usage would be affected by cue similarity, since otherwise there would be low frequency of spontaneous use for these categories.

All Ss learned the first list, composed of two 10-word categories, to a criterion of 12 correct in an alternating study trial/free recall procedure. Control Ss then worked a puzzle, while Experimental (E) Ss learned a second list with either the same two, or two new categories, for six trials. Physical context change involved differences in the size and furnishing of the experimental room, in S's posture during learning, in the presentation device for the lists, in various incidental auditory stimuli, and in the visual presence or absence of the experimenter. All Ss finally attempted to recall the words of both lists for the single list learned, in any order, in the original context, with the concept names provided. A subsequent task of sorting the words from the first and second lists was administered to the E groups.

The findings indicated that physical context in general was not an important variable in RI for FRL. The RI of the Uninstructed-Different-Concept group was reduced by context manipulation, but the pattern of results suggested that disruption, and not the physical context per se, was the critical factor. There was no evidence that physical context change affected Ss' ability to sort the lists subsequent to recall, although performance even for the unchanged context conditions was nearly perfect. It was concluded that a re-evaluation of the nature of the stimulus for the contextual association is needed, with one possible alternative to physical context being that of subjective temporal factors.

With regard to cue overlap for interitem associations, for the groups instructed to use the concepts there was RI only for the Same-Concept condition. For the uninstructed groups there were substantial and equal amounts of RI for both the Same and Different conditions. These findings are consistent with earlier word, and fit predictions from both the unlearning hypothesis derived from classical verbal learning paradigms and an explanation in terms of an overloading of a retrieval cue, but only if it is assumed that Ss in the uninstructed condition attempt to impose similar subjective organization schemata on the successively learned lists.